

DEVELOPMENT OF CONCEPTUAL AND PROCESS MODELS OF GROWING  
PAINS: A MIXED-METHOD RESEARCH DESIGN

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By

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## ABSTRACT

Despite being a common childhood complaint there is little research on growing pains. Existing research is inconsistent with regard to sample selection and prevalence rates. There are only two English language intervention studies, and with the exception of associations noted in prevalence research, there has been no systematic research on the potential impact of growing pains on daily activities. Lack of a universal definition of growing pains poses difficulty for both diagnosis and research. The purposes of the current investigation were to propose a definition of growing pains grounded in literature and clinical practice, to develop a conceptual model of growing pains, and to understand children's experiences with growing pains. A mixed-method research program involved four phases. In phase I, a survey of physicians indicated the following definition of growing pains: Intermittent pain of unknown etiology, occurring nocturnally in the lower limbs. Features that may occur in some cases, but not part of the definition, include arm pain and daytime pain. In phase II, non-parametric statistical analyses of child, familial, and environmental variables in a rheumatology clinic database were conducted to determine potential risk factors for growing pains. Logistic regression modeling indicated an association between growing pains and maternal illness or rash during the pregnancy, maternal smoking during the pregnancy, delayed pull to standing (i.e., greater than age 10 months), and family histories of back pain and arthritis. Potential mechanisms for these empirical associations are explored. In phase III, qualitative interviews with children were conducted to develop a grounded theory of how children

process their experiences. Children engaged in a process of evaluating their current and past experiences of growing pains to determine how to manage specific pain episodes. Their evaluation was influenced by how they understood their pain which in turn was influenced by their intrapersonal and interpersonal experiences. Phase IV integrated results and existing literature to develop a conceptual model of growing pains which outlines characteristic features, predisposing factors, triggers, alleviating actions, and associated psychosocial features. Implications of the process theory and the conceptual model of growing pains with regard to clinical practice and future research are discussed.



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## LIST OF ABBREVIATIONS

JIA	Juvenile Idiopathic Arthritis
RLS	Restless legs syndrome

## GLOSSARY

**Conceptual model:** a descriptive model of factors or concepts relevant to a particular entity and the relationships among them.

**Grounded theory:** a method of conducting qualitative research such that a theory or conceptual framework is created through inductive analysis of data (Charmaz, 2006; Strauss & Corbin, 1998).

**Process model:** a model defining a process (cognitive, emotional, behavioural and/or interpersonal) that takes place in relation to a particular phenomenon. In the case of this dissertation the model is a theoretical process model (developed inductively) describing series of actions or processes that might occur among children who have growing pains.

Medical terms are defined in context using footnotes.

## CHAPTER 1 GENERAL INTRODUCTION

Despite being a common childhood pain, and a cause of frequent visits to family physicians (Macarthur, Wright, Srivastava, Walter, & Feldman, 1996) and to rheumatology clinics (Denardo et al., 1994), growing pains<sup>1</sup> is a condition that is poorly understood. The term “growing pains” has been used in the academic and lay literature to refer to a type of recurrent limb pain of unknown etiology. Growing pains is classified as a recurrent pain as it is episodic. The International Association for the Study of Pain (IASP) defines pain as: “An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage” (Mersky & Bogduk, 1994). Further, the IASP definition of pain includes the following statements: “Many people report pain in the absence of tissue damage or any likely pathophysiological cause...There is usually no way to distinguish their experience from that due to tissue damage if we take the subjective report. If they regard their experience as pain and if they report it in the same ways as pain caused by tissue damage, it should be accepted as pain.” Growing pains is not associated with tissue damage and there is no known pathophysiological cause.

Pain is a complex phenomenon; the subjective experience of pain is influenced by interplay of various factors including: physiological mechanisms (Melzack & Wall, 1996); biological predispositions (Varni et al., 1996); individual differences such as early

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<sup>1</sup> Growing pains is treated as a singular noun throughout this dissertation because it is a singular condition.

pain experiences, cognitive development, temperament and perceived coping ability (McGrath, 1995; Zeltzer, Bursch, & Walco, 1997); and environmental factors such as cultural attributions about pain, socialized gender differences and family factors (Zeltzer, Bursch, & Walco, 1997). Some children with chronic or recurrent pain are severely affected by their pain and experience associated emotional difficulties and decreased functional status (Hunfeld et al., 2001; Perquin et al., 2003; Varni et al., 1996). In community samples the most common types of childhood recurrent and chronic pain are limb pain, headache and abdominal pain (Perquin et al., 2000; van Dijk, McGrath, Pickett, & VanDen Kerkhof, 2006). There has been comparatively little research on recurrent limb pain as compared to headache and abdominal pain.

There are a variety of causes of chronic or recurrent limb pain in children. Limb pain can be classified based on organic causes, unknown etiology, or psychogenic etiology. It should be noted that to meet criteria for psychogenic etiology the symptoms have to consistently be associated with negative events and it has to be clear that there is no organic cause. However, exacerbation of symptoms due to psychosocial factors can occur even when pain is organic. Limb pain due to organic causes can fall into the following categories: trauma, infection, orthopedic, collagen vascular<sup>1</sup>, hematologic<sup>2</sup>, neoplastic<sup>3</sup>, endocrine<sup>4</sup>, nutritional, and other miscellaneous etiology (Bowyer & Hollister, 1984; Leduc, 1986). Growing pains is classified as limb pain of unknown

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<sup>1</sup> Collagen vascular diseases (also called connective tissue diseases) such as rheumatoid arthritis and systemic lupus erythematosus (SLE) are characterized by over-activity of the immune system affecting connective tissues. SLE is an inflammatory autoimmune disorder that may affect skin, joints, kidneys and other organs.

<sup>2</sup> Hematologic diseases are associated with blood and blood forming tissues.

<sup>3</sup> Neoplastic diseases are characterized by abnormal growths in cells including tumors.

<sup>4</sup> Endocrine diseases are those that are associated with the endocrine system.

etiology. Other musculoskeletal syndromes of unknown etiology include diffuse idiopathic pain syndromes, such as fibromyalgia, and localized idiopathic pain syndromes, such as complex regional pain syndrome type 1, where the pain is localized to one limb (Sherry & Malleson, 2002).

The International Statistical Classification of Diseases & Related Health Problems 10<sup>th</sup> Revision (ICD-10), developed by the World Health Organization, codes growing pains in the category called “symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified.” Within this category, growing pains falls under the sub-category called “symptoms and signs involving the nervous and musculoskeletal systems,” and within this sub-category, growing pains falls under the following code: “other and unspecified symptoms and signs involving the nervous and musculoskeletal systems.”

Growing pains lacks a common definition and there are no universal diagnostic criteria. A definition should include the necessary features of a condition, which also constitute diagnostic criteria. Definitions do not include diagnostic exclusionary criteria. For example, defining growing pains as “recurrent nocturnal limb pain of childhood,” does not include the diagnostic exclusion criterion of no limping. Descriptive features of the condition appearing in some cases of growing pains, but not constituting necessary features, do not form part of the definition and should not be included as exclusionary diagnostic criteria. There can be distinctions between clinical diagnostic criteria and research diagnostic criteria. Diagnostic criteria for research may be stricter as a clinical evaluation to confirm the diagnosis, and to rule out other possible conditions, might not be possible. For example, a research criterion could be bilateral pain, whereas clinically,

in some cases, children with unilateral pain might be diagnosed with growing pains if other possible rheumatic conditions are excluded upon clinical evaluation. Table 1.1 depicts the distinction between definition of growing pains, associated features, and diagnostic exclusion criteria. References are provided where discrepancies exist among authors regarding diagnostic criteria, definition, or associated features.

Diagnostic criteria for growing pains include the following components: location of the pain; time of day of occurrence; frequency of occurrence; and absence of objective clinical findings (i.e. no clinical abnormalities such as swelling, tenderness, joint pain, or limited movement; Atar, Lehman, & Grant, 1991; Homeier, Dowshen, & Cooper, 2004). With regard to location of the pain, growing pains is described by some practitioners as occurring solely in the lower limbs (Brady & Grey, 1989; Peterson, 1986) and by others as occurring in the lower and/or upper limbs (Oberklaid et al., 1997; Oster & Nielsen, 1972). Typically, growing pains is considered an evening or night-time occurrence (Atar et al., 1991; Peterson, 1986), but some definitions include daytime pain (Abu-Arafeh & Russell, 1996; Oberklaid et al, 1997). Growing pains is defined as an intermittent pain. Naish and Apley's (1951) criterion of the pain occurring at least three times within a three month period is often cited in the research literature. The diagram in Figure 1.1 is included to clarify the distinction between growing pains and other types of limb pains and presents hypothetical subgroups of growing pains based on the various definitions in the literature.

Table 1.1 Growing Pains: Definition, Associated Features, and Diagnostic Criteria

	Definition/ Necessary features/ Diagnostic inclusion criteria	Associated features (permitted but not required)	Diagnostic exclusion criteria
Time of onset	Evening or night time pain	Daytime pain <sup>1</sup>	Pain upon waking <sup>2</sup>
Frequency of pain	Episodic		Continuous
Location of pain	Leg pain <sup>3</sup>	Arm pain	
	Bilateral pain <sup>4</sup>		Unilateral pain
		Joint pain <sup>5</sup>	Joint pain <sup>6</sup>
Laboratory tests	Normal laboratory results		Abnormal laboratory result
Physical exam	Normal clinical exam		Swelling, tenderness, erythema, limping, limited mobility, local trauma or infection
Other Symptoms		Other recurrent pain  Minor postural abnormalities	Delay in motor milestones <sup>7</sup>

<sup>1</sup> Abu-Arafeh & Russell, 1996; Oberklaid et al., 1997

<sup>2</sup> Evans & Scutter, 2004a, 2004b; Peterson, 1977, 1986

<sup>3</sup> Oberklaid et al., 1997, Oster & Nielsen, 1972, and Seham & Hilbert (1933) included arms or leg pain in their definition, suggesting that leg pain was not a necessary criterion

<sup>4</sup> Some authors do not consider bilateral pain necessary (Abu-Arafeh & Russell, 1996; Oberklaid et al., 1997)

<sup>5</sup> Abu-Arafeh & Russell, 1996; Oberklaid et al., 1997

<sup>6</sup> Evans & Scutter, 2004a, 2004b; Naish & Apley, 1951; Oster, 1972a; Oster & Nielsen, 1972; Peterson, 1977, 1986

<sup>7</sup> Foster, Boyd, & Jandial, 2008

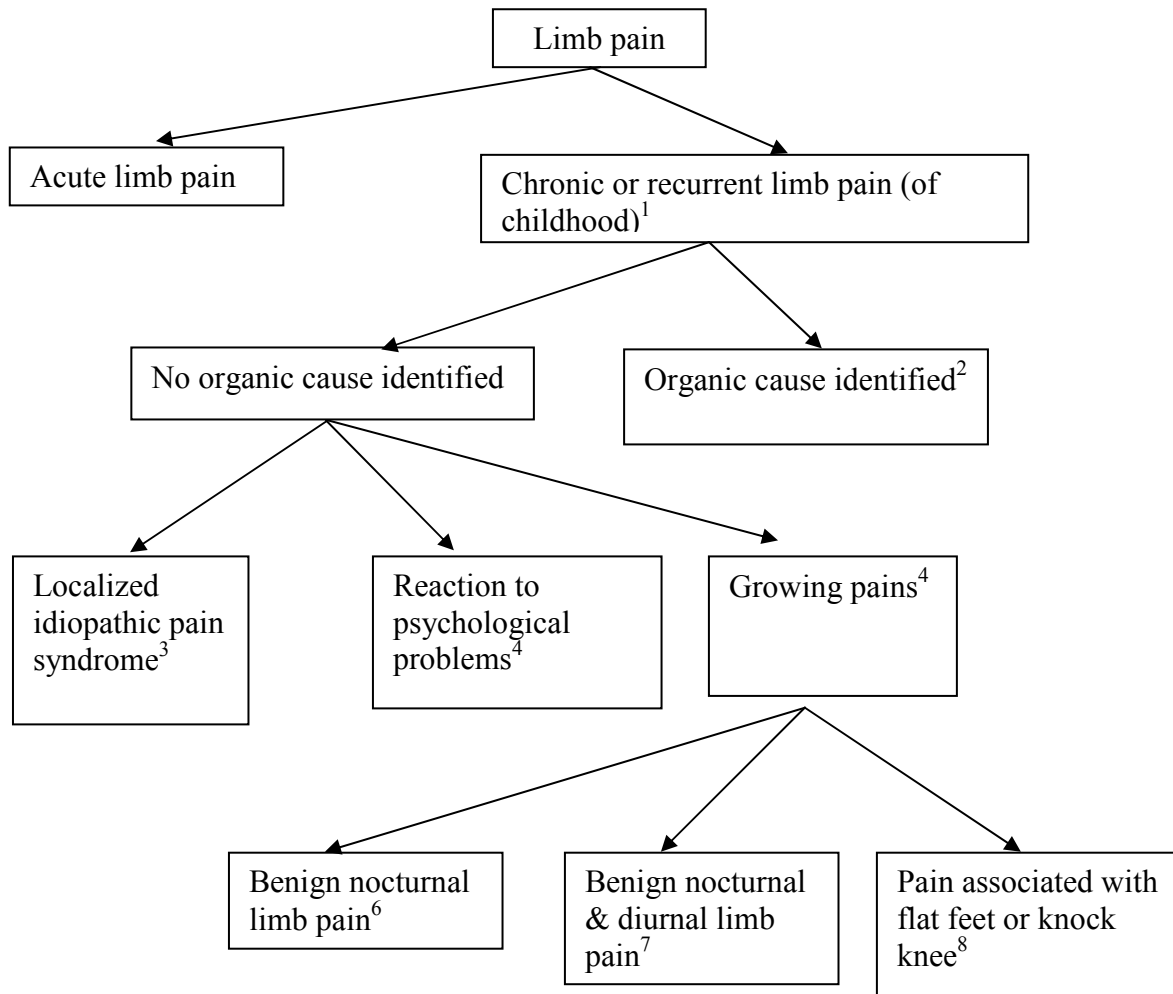


Inconsistent definitions are problematic for a number of reasons. First, inconsistent definitions invite inconsistency in diagnosis. For example, a physician using the criterion of only lower limb pain might not diagnose growing pains in a child presenting with intermittent pain in both the upper and lower limbs, whereas another physician, using the criterion of lower limb pain and considering upper limb pain a feature, would diagnose this same child with growing pains. Diagnostic clarification is necessary to reduce the likelihood of both false positives (diagnosing a child with growing pains when the child does not have the condition) and false negatives (not diagnosing growing pains when the child does have the condition). Misdiagnosis is especially concerning when a child presents as having growing pains, but in fact has a serious disease such as a neoplastic<sup>1</sup> disorder or a rheumatic disease. Second, inconsistent definitions result in inaccurate prevalence rates. Third, we do not know the extent to which results across research studies can be compared because of sampling differences due to varied definitions. Fourth, it is possible that lack of a common definition is a contributory factor to the paucity of research on growing pains.

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<sup>1</sup> Neoplastic diseases are characterized by abnormal growths in cells including tumors.

Figure 1.1 Classification of Limb Pain in Childhood



1. Pain occurring over a period of at least three months.

2. Examples of organic causes are trauma, infection, and orthopedic conditions.

3. The pain is localized to one limb.

4. This diagnosis cannot be one of exclusion; there must be positive evidence such as the pain consistently being associated with perceived negative events (however, this can occur even if the pain does not have a psychological cause).

5. Pain of unknown origin occurring in the legs or in both the legs and arms.

6. There may be interference with sleep.

7. The pain may cause interference with daily activities.

8. This subgroup is placed under the growing pains category because it represents a group of children who have the characteristics of growing pains but who also have a possible organic cause for the pain.

Assumptions about the benign nature of growing pains might also be a factor contributing to the lack of research on growing pains. It could be assumed that because the pain is benign it might not be a worthwhile endeavor to investigate potential etiology and effective treatment. In the medical literature the term benign is used to describe conditions that are nonmalignant as well as conditions that are harmless in the sense that they present little or no threat to health. Growing pains is considered a benign pain from a biomedical perspective because it is intermittent, believed to be limited to childhood, and there is no evidence suggestive of long-term physiological impact or future rheumatic or other musculoskeletal disease. From a psychological perspective, however, if growing pains was associated with decreased psychosocial functioning it would not be considered benign. It is possible that some children with poor coping skills may experience distress related to having growing pains and/or be at risk for developing a chronic pain syndrome in adulthood.

It is important to be aware of our assumptions versus our knowledge about growing pains. It is assumed that because the pain is described as benign that there is no significant impact of the pain. However, we do not know whether some individuals with growing pains are at risk for chronic pain in adulthood, either through a physiological mechanism, or through poor pain coping skills, or both. It is also assumed that because adults do not present to their general practitioners with complaints of so-called “growing pains” that there is no long-term impact of the pain; however, we do not know if some individuals continue to experience their growing pains into adulthood or a variant of the condition. To understand growing pains we need not only a definition of what the condition is, but also, we need to know how children and their parents experience

growing pains. Do they perceive it as benign? What do children learn about pain and their ability to cope with pain from their experiences with growing pains?

The primary purpose of this program of research was to propose a common definition of growing pains and to develop a conceptual model of growing pains. Originally, it was proposed that the model would describe the pain, associated conditions, and risk factors. Through the course of the research a theoretical process model was developed in addition to a descriptive conceptual model. The process model not only describes the pain and associated features, but also describes the process of children's experiences in understanding and managing their growing pains. The process model, together with the descriptive conceptual model, can be used as a springboard for determining useful research questions and for investigating effective intervention approaches. A secondary purpose of this research was to propose questionnaire items that, once validated, could be used in future research studies to assess symptoms associated with growing pains. This program of research utilized a mixed-method design consisting of three original stand-alone studies. The four phases of this research consisted of the following:

Phase I: Development of a definition of growing pains through surveying physicians about how they define and diagnose growing pains.

Phase II: Statistical and descriptive analyses of a rheumatology clinic database to identify risk factors for growing pains and associated features.

Phase III: Qualitative study utilizing grounded theory methodology to develop a theoretical process model of children's experiences with growing pains.

Phase IV: Integration from the previous phases to develop a descriptive conceptual model of growing pains and to propose items for questionnaires designed to assess symptoms associated with growing pains.

Before addressing these phases of the research, a literature review is provided as background information and to further elucidate the rationale for the current research.

## CHAPTER 2 LITERATURE REVIEW

### 2.1 Definitions of Growing Pains

#### 2.1.1 Historical Perspective

Growing pains is said to have been first described in the academic literature in 1823 by Duchamp, a physician who concluded that growth in children caused limb pain which was apparently absent in adults (Al-Khattat & Campbell, 2000; Atar, Lehman, & Grant, 1991; Baxter & Dulberg, 1988; Calabro, Wachtel, Holgerson, & Repice, 1976; Evans, Scutter, Lang, & Dansie, 2006). In a monograph published in 1823, Duchamp provided a series of case studies and noted that growth spurts could be accompanied by rashes in some children. Subsequent to Duchamp's description of the condition, it appears to have been widely believed during the nineteenth and early twentieth century that growing pains was a form of rheumatism<sup>1</sup> (Seham & Hilbert, 1933; Williams, 1928), which could be associated with rheumatic carditis<sup>2</sup> (Naish & Apley, 1951; Wilson & Kopel, 1926).

The existence of the condition was contended in 1894 by Bennie, who argued that children were being misdiagnosed as having growing pains and that there was no evidence that growth caused pain. He warned that the following conditions were often

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<sup>1</sup> Rheumatism is a term used historically to describe a range of medical problems affecting the joints and various organs.

<sup>2</sup> Rheumatic carditis is inflammation of the heart associated with rheumatism.

misdiagnosed as growing pains: Myalgia from fatigue, rheumatism, diseases of the joints and bones of the lower extremities, fevers; and adenitis<sup>1</sup>. Bennie stated that growing pains were being defined at the time as “pains in the limbs caused by and during rapid growth and sometimes so severe as to give rise to growing fever” (p. 337). According to Bennie, additional features that some of his colleagues believed to be characteristic of growing pains included the following: pain “invariably at the extremities of the long bones, at the epiphyses<sup>2</sup>, at the line of cartilage between them, and in the shafts” (p. 344); pain in the lower limbs more predominantly than pain in the arms; frequent pain around the knees and ankles; higher prevalence in boys; increased severity of pain in the evening or night; occurrence when children were more active as they began recovery from fevers; indigestion; headache; hyperemia<sup>3</sup>; formation of bony tumors in some children; relief through good feeding and rest.

In 1910, Brown defined growing pains as nocturnal pain in the legs and back. He postulated that the pain was caused by contraction of sacral muscles and ligaments during the day, and consequent relaxation of these muscles in the night, resulting in strained sacro-iliac joints and transmission of the irritation to the lumbosacral cord or the sacral plexus. He also stated that the pain could be triggered by sitting or standing in the same position for a while. Brown observed that children with growing pains tired quicker than other children during the day.

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<sup>1</sup> Adenitis is an inflammation of a lymph node.

<sup>2</sup> Epiphyses are the ends of long bones. Before growth is complete and ossification occurs, the epiphysis is separated from the main bone by cartilage.

<sup>3</sup> Hyperemia is an excess of blood in a body part. In this case the hyperemia would be where the growth was occurring.

In 1939 Shapiro described growing pains as a non-rheumatic condition, noting that in the group of patients he followed children did not develop well known symptoms of rheumatic infection including nosebleeds, skin rash, joint pains or fever. Further, the children with growing pains tended to have pain at the end of the day, whereas patients with “joint pains of subacute rheumatic fever” had pain when getting out of bed in the morning and during the entire day. Children with growing pains also had normal findings on blood analysis, whereas children with “joint pains of subacute rheumatic fever” did not.

### **2.1.2 Current Definitions and Diagnostic Criteria**

Growing pains is typically defined today as pain in the limbs of unknown etiology. Recently, Uziel and Hashkes described growing pains as a common “type of non-inflammatory pain syndrome” (2007, p.1). A review of reports in medical journals indicated that there are inconsistent anecdotal reports attempting to characterize features of growing pains. These reports include descriptions of features such as: “pain “resolv[ing] over 6 to 24 months” (Halliwell & Monsell, 2001, p.621); pain most likely occurring “between 12 midnight and 2 am” (Manners, 1999, p.124). Doughty (1988) defined growing pains in the following manner: “Intermittent pains or aches localized (usually) to the legs occurring over several months to years in children between the ages of 3 and 12 with no definable medical pathology.” There is no research evidence supporting the use of an age range as a diagnostic criterion. Foster, Boyd, and Jandial (2008) included the criterion of normal motor milestones for diagnosis of growing pains, noting that “any suggestion of delay in major motor milestones excludes growing pains as a diagnosis” (p.3). There is no research evidence supporting the criterion of delayed motor development as exclusionary of growing pains. Growing pains has been described



as a diagnosis of exclusion (Doughty, 1988; Halliwell & Monsell, 2001). Various diagnostic tests (hemoglobin level, white blood cell counts, erythrocyte sedimentation rate<sup>1</sup>, radiographs, and bone scans) have been used to rule out the presence of other musculoskeletal conditions, tumors and infections when the child does not have all the typical signs of growing pains (Macarthur et al., 1996).

Peterson (1977, 1986) summarized the literature on growing pains to provide a definition of the condition. He defined growing pains as intermittent, usually located in the lower limbs, bilateral, non-articular, and typically occurring late in the day and in the evening. Peterson's definition indicates that joint pain is an exclusion criterion for growing pains and yet some studies have included children with joint pain (Abu-Arafeh & Russell, 1996; Oberklaid et al, 1997).

### **2.1.3 Subgroups of Growing Pains**

It is unclear whether growing pains is a single entity or whether there are subgroups of growing pains. In their prevalence study, of 721 children aged 8 to 12 years, Naish and Apley (1951) divided their sample into three groups: 1) "Ill-defined pains" – this group was characterized by children who had diurnal and nocturnal pains in the limbs and body; 2) "Diurnal fatigue pains" – this group was characterized by children who had predominantly diurnal pain, particularly after increased activity, and by children who had postural abnormalities, "emotional disturbances", and/or a family history of "rheumatic disorders"; and 3) "Paroxysmal nocturnal pains" – this group was characterized by children whose pain was predominantly nocturnal. In this group, the

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<sup>1</sup>Erythrocyte sedimentation rate is the rate at which red blood cells settle under standardized conditions in a tube of blood. An increased rate indicates the presence of certain proteins associated with rheumatic diseases, malignant diseases, or chronic infection.

pain was more frequent in wet or cold weather and there tended to be a positive family history of growing pains.

Craft (1999) proposed that the diagnosis of growing pains fit into one of the following categories: night cramps, hypermobile joints, or psychosomatic pains.

Pountain and Vaughan-Lane (2004) suggested that children with hypermobility would benefit from exercises geared towards strengthening and stabilizing their muscles.

Sheldon (1951) described growing pains as falling into two categories – growing pains related to atmospheric changes and growing pains related to fatigue. Sheldon kept track of when patients presented at a rheumatology clinic and noted that the incidence of growing pains was higher during damp weather. This finding does not exclude the possibility that children were experiencing growing pains during warmer conditions. Sheldon recommended that children should sleep between blankets rather than sheets in order to prevent pain associated with cold and dampness. He also recommended that children be allowed to change shoes at school during wet conditions. Sheldon noted that children with postural abnormalities and obese children fell into the category of fatigue related pain.

Lowe and Hashkes (2008) suggested that some children with growing pains present with a fibromyalgia variant (i.e. having tender points, multiple pains, and/or disturbed sleep) and that these children might benefit from treatment including improved sleep hygiene, aerobic activity, physical therapy and cognitive behavioural therapy.

#### **2.1.4 Terminology**

The term “growing pains” implies that the pain is caused by growth. However, considering that there is limited evidence supporting this theory, the term growing pains is considered by some to be a misnomer (Naish & Apley, 1951; Seham & Hilbert, 1933;

Sheldon, 1951). In 1976, Apley stated his preference for the term “limb pain syndrome” because it indicated that there could be a variety of contributory factors to the pain. Other terms used in the academic literature on growing pains include: “recurrent limb pain of unknown aetiology” (Abu-Arafeh & Russell, 1996), “growing pain syndrome” (Baxter & Dulberg, 1988), and osteomuscular pains of unknown origin (Lech, 2002). Al-Khattat and Campbell argued in 2000 that the term “recurrent limb pain in childhood” should be adopted as a term that includes growing pains amongst other conditions. However, adopting this term would still necessitate use of the term growing pains to distinguish this type of pain from other recurrent lower limb pains.

## **2.2 Prevalence Studies**

Prevalence rates of growing pains vary widely. Recent studies indicate prevalence rates from 2.6% (Abu-Arafeh, 1996) to 11.4% (Oberklaid et al., 1997) in community samples. Evans and Scutter (2004a) utilized a separately validated questionnaire to identify children with growing pains and documented a community prevalence rate of 36% in children aged four to six years. The variation in prevalence rates is likely due to differences in diagnostic criteria as well as to differences in the ages included. It is also possible that regional differences may influence prevalence rates. The lowest prevalence rate of 2.6% was found in a community sample of children aged 5 to 15 years (Abu-Arafeh & Russell). Children with pain centered on major joints were included in this study. However, exclusionary criteria included symptoms of swelling, limitation of joint movements, tenderness and joint hyperextensibility. Table 2.2 presents a summary of the epidemiological studies on growing pains. A detailed discussion of each of the prevalence studies follows.

Table 2.2 Summary of Epidemiological Studies on Growing Pains in Chronological Order\*

Author	Sample size	Prevalence	Age	Inclusion Criteria	Features
Williams (1928) England	1277 (community sample)	37.5%	8 – 12 and older (entire age range sampled was not given)	Not given	<sup>1</sup> Nodules or grains over the ulna and/or spine; nosebleed
Hawksley (1931) England	711 (hospital clinics)	29-57.7% (prevalence was given according to ethnicity)	4-14	Pain in the limbs which could not be explained	None given
Seham & Hilbert (1933) United States	208 (hospital clinics)	22.6%	7-15		Poor sleep, fatigue, high streptococci agglutination titer <sup>2</sup> and sedimentation rate
Naish & Apley (1951) England	721 (community sample)	4.2% (boys 4.0%; girls 4.7%)	Analyzed children aged 8-12 (the full age range was not specified)	Pain for at least 3 months, not in the joints, some interruption of normal activities	Fatigue or exertion, damp, more frequent occurrence in winter, postural defects, family history of rheumatism, emotional problems

\*Studies included were limited to those in English

1. A nodule is a small round or oval subcutaneous mass of tissue.

2. A streptococci agglutination titer measures the concentration of streptococci bacteria.

Table 2.2 (continued) Summary of Epidemiological Studies on Growing Pains in Chronological Order\*

Oster & Nielsen (1972) Denmark	2178 (Community sample)	Boys 6-19 12.5% Girls 6-17 18.4%	6-19	“intermittent and frequently quite incapacitating pain localized deeply in the arms and/or legs,” non-articular	39.2% also had headache and or recurrent abdominal pain
Abu-Arafeh & Russell (1996) Scotland	2165 (Community Sample)	2.6% (boys 2.3%; girls 2.9%)	5-15	Two episodes of limb pain over one year, lasting no more than 72 hours. No limitation of joint movement or joint hyper-extensibility	Pain exclusive to lower limbs; 38% had pain in joints; 33% pain interfered significantly with activity; 60% pain occurred at any time of the day; 29% pain after 5pm; 53% had another recurrent pain
Oberklaid et al. (1997) Australia	1605 (Community Sample)	11.4%	Mean age 8.5	Pain in arms, legs or joints over 12 months	53% diurnal pain; 22% pain precipitated by exercise; 25% awakened from sleep; 33% complained of restlessness; 33% fatigue; 18% weakness; 11% stiffness
Evans and Scutter (2004a) South Australia	1445 (community sample)	36.9% (95% CI, 32.7-41.1)	4-6	Intermittent, bilateral, non-articular, no objective findings	None given

\*Studies included were limited to those in English

Williams's study in 1928 was conducted at a time when growing pains was thought to be a form of rheumatism. She divided her sample based on their living environment and noted that there was a higher prevalence of growing pains in rural areas (39.6%) compared to semi-urban areas (34.3%). Williams determined that there was no association between growing pains and decaying teeth or enlarged tonsils in her sample. She noted an association (based on frequencies) between cardiac defects and growing pains, but only in children aged 12 years. Williams also noted that the presence of nodules<sup>1</sup> was high in children with growing pains, but stated that it was unknown whether nodules also occur in other conditions. Based on her observations, Williams noted that there was a high frequency of nosebleeds in children with growing pains. Williams did not provide the criteria she used to determine whether a child had growing pains. Also, she did not state the entire age range that was sampled.

In 1938, Hawksley determined that 29 – 57.7% of children (prevalence was given according to ethnicity) aged 4-14 years, who attended hospital clinics in two major cities in England, were experiencing growing pains. Growing pains was defined as pain in the limbs which could not be explained. Children of the “Nordic type,” defined as having light eyes and light hair, had a lower prevalence of growing pains compared to children of the “Mediterranean and Intermediate type,” defined as having dark eyes and dark hair and as having dark eyes and light hair, respectively. Hawksley concluded that children of the Mediterranean or Intermediate type may be more susceptible to growing pains due to metabolic factors or to greater pain sensitivity. Having dark skin is associated with lower Vitamin D concentrations (Rovner & O'Brien, 2008) and Vitamin

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<sup>1</sup> A nodule is a small round or oval subcutaneous mass of tissue

D deficiency is one of the factors associated with musculoskeletal pain (Lee, 2006; Mascarenhas, 2004; McNally, Matheson, & Rosenberg, 2009). Although the categorization of ethnicity was subjective, the study suggests that there could be ethnic differences predicting which parents are more likely to take their children to hospital clinics because of symptoms of growing pains.

Seham and Hilbert (1933) found a prevalence of 22.6% in their sample of children with growing pains (aged 7 to 15 years). They did not state how the sample was derived, but noted that they determined whether the child had growing pains through use of a reliable questionnaire. Growing pains was defined as pain in the lower or upper limbs that lasted for at least 3 months. Children with flat feet, scoliosis, and synovitis, were excluded. Seham and Hilbert compared children with growing pains to healthy children and noted that in their sample there were relationships between growing pains and inadequate sleep and between growing pains and fatigue. They also found that the growing pains group had a high streptococcic agglutination titer<sup>1</sup> compared to a control group.

Naish and Apley (1951) found that in a British community sample of 721 children aged 8-12 years, 4.2% experienced growing pains. They defined growing pains as limb pain in either the lower or upper limbs, or both, “of at least three months duration, not specifically located in the joints, and of sufficient severity to cause some interruption of normal activities” (p.134). The types of daily activities that were affected were not described and, therefore, in using this definition, there is no defined criterion to determine the extent to which the pain has to interfere with activity or to determine what type of

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<sup>1</sup> A streptococci agglutination titer measures the concentration of streptococci bacteria.

activity is affected. The sample consisted of children who experienced diurnal or nocturnal pains or both. For those children with diurnal pain, the pain was aggravated or brought on by fatigue or exertion. Naish and Apley also found that emotional disturbances (defined as emotional instability, irritability, nervous troubles, fear of the dark), were more commonly associated with diurnal pain; however, they did not use a validated measure of emotional disturbance. Children with growing pains were found to have a greater frequency of family history of rheumatic problems compared to healthy children.

Oster and Nielsen (1972) found that in a community sample of 2178 children in Denmark, 12.5% of boys (aged 6-19) and 18.4% of girls (aged 6-17) experienced “intermittent and frequently quite incapacitating pain localized deeply in the arms or legs” (p. 61). However, there was no measure of how the pain was incapacitating. Of the children studied 39.2% also experienced headaches and/or recurrent abdominal pain. Hashkes, Gorenberg, Oren, Fridland and Uziel (2005) noted an increased prevalence of migraine headaches in families of children with growing pains. However, when they compared 11 children with growing pains who underwent bone scans to 12 healthy children, they found that there were no differences among the groups in vascular perfusion patterns<sup>1</sup> in the mid-femur (non painful region) and mid-tibia (painful region) or in other localities. This finding suggests that the etiology of growing pains differs from that of migraine headache where there is a known association with vascular perfusion changes.

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<sup>1</sup> Vascular perfusion pattern is the pattern or rate of blood flow in a particular area of the body.



Abu-Arafeh and Russell (1996) found that in a community sample of 1754 children in Scotland, 2.6% had experienced at least 2 episodes of recurrent limb pain of unknown etiology during the previous year. Among these children, 33% experienced inhibited normal activity as a consequence of pain. However, the authors did not provide an indication of the type of activity that pain interfered with. Symptoms started as young as 2 years with a mean age of onset at 7 to 8 years. Surprisingly, the mean duration of each episode was 10 hours with a median of 2 (range 1 to 48). Sixty percent of the children with recurrent pain of unknown etiology experienced pain at any time of the day, showing no consistent pattern with regard to the time of day they experienced pain. In contrast, twenty-nine percent of the children consistently experienced pain after 5 pm. Children with recurrent limb pain experienced similar triggering factors as children with migraine headache, including tiredness (examples of other triggers were not given). A strength of this study was the use of multiple methods of diagnosis which included a screening questionnaire, clinical interview and physical examination.

Oberklaid and colleagues (1997) found that 11.4% of children, in a community sample of 1605 eight-year-olds in Australia, experienced pain in the arms, legs or joints in the previous year. The mean duration of pain episodes was 2.9 hours. Among these children, 53% experienced diurnal pain, 52% complained of restlessness, 33% complained of fatigue, 25% awakened from sleep, in 22% the pain seemed to be precipitated by exercise, 18% experienced weakness, and 11% experienced stiffness. There was a family history of similar pain among 66% of the children and a family history of arthritis among 51%. Age, sex, birth-order, parents' marital status, ethnicity, and socio-economic status were not related to pain. Children with growing pains were

significantly more likely to experience abdominal pain and headaches compared to healthy children. Children with growing pains were more likely to be rated by their parents, but not teachers, as being intense, aggressive, anxious, hyperactive, and having negative mood and overall behaviour problems. It is difficult to generalize from this study because the criteria used for growing pains were pain in the arms, legs, or joints. There may, therefore, have been children in this study that in fact did not have growing pains.

Evans and Scutter (2004a & 2004b) designed a questionnaire to determine the prevalence of “recurrent leg pains, often described as ‘growing pains’ ” (p. 255), in children aged 4 to 6 years of age in South Australia. The estimated prevalence was 36.9%. They used the following definition provided by Peterson (1986) to determine whether children had growing pains: intermittent, non-articular, bilateral pain occurring late in the day or at night, and no objective findings. Seventy percent of the children with growing pains had a parent or sibling with a history of growing pains.

Van Dijk, McGrath, Pickett, and VanDenKerkhof (2006) found a growing pains prevalence of 21% among 495 children aged nine to 13 years in a community sample. The prevalence of growing pains among children with other recurrent pains was 37%. Prevalence rates of growing pains were very similar among males with recurrent pains (38%) and females with recurrent pains (37%). However, this study is limited in that it is possible that some of the children identified as having growing pains might have had another type of recurrent limb pain. Children were not screened for whether they had bilateral pain, primarily nocturnal pain, or indicators of pain other than growing pains such as joint pain, swelling, or limping.

Prevalence studies indicate that there may be functional disability associated with growing pains such as sleep disturbance (Oberklaid et al., 1997; Seham & Hilbert, 1933) and interference with daily activities (Abu-Arafeh & Russell, 1996). There is a need to assess the extent and domains of functional disability in order to include them as outcome variables in intervention programs. The studies also indicate that there is a high prevalence of growing pains and rheumatic complaints among family members of children with growing pains (Evans & Scutter, 2004b; Seham & Hilbert, 1933). Possible explanations for this could include a genetic predisposition to limb pain or to pain sensitivity or shared environmental factors.

The initial prevalence studies on growing pains in the early 20<sup>th</sup> century were conducted at a time when growing pains was thought to be a form of rheumatic fever. In addition to examining prevalence rates these studies involved looking at other medical conditions potentially associated with rheumatic fever. In this context it is not surprising that the early studies utilized hospital samples. Naish and Apley's study in 1951 was the first to document research criteria for sample selection based on the frequency of pain episodes and interference with activity. Additionally, this was the first study that examined psychosocial factors potentially associated with growing pains. One of the difficulties in drawing conclusions from this literature regarding variables associated with growing pains is the variation in symptoms experienced by children across these studies, with some studies including children with daytime and joint pain, and other studies excluding children with these symptoms. Another difficulty in making comparisons across these data regarding factors associated with growing pains is that the nature of data obtained was dependent on the types of questions asked. For example, some studies did

not ask about interference with activity. Also, we cannot assume that the definition of limited activity in one study was the same as in another.

## **2.3 Etiological Theories**

There are currently four theories of causation of growing pains: growth of the bone or soft tissue, fatigue, psychosocial problems, and orthopedic abnormalities.

Recently, there has been suggestion in the literature that chemical imbalances may also play a role. None of the theories of growing pains have been substantiated and growing pains is largely considered a condition of unknown etiology.

### **2.3.1 Growth**

Growth theories suggest that the pain is associated with periods of rapid growth, or with the bone growing faster than tendons and muscles, resulting in stretching of soft tissue (Lowe & Hashkes, 2008). However, anecdotal reports and results from prevalence studies indicate that growing pains is uncommon during periods of maximum growth, suggesting that bone or tissue growth is not a causal factor (Baxter & Dulberg, 1988; McGrath & Unruh, 1987). Atar, Lehman, and Grant (1991) stated that growth rate declines at the time when the incidence of growing pains seems to peak -- at ages 4 and 12 years. This observation is supported by Brown, Lehman, Peterson, and Maher (1998) who cite periods of peak growth as being during the first 3 years and between ages 12 to 15 years. Brown and his colleagues also argued that if growth were associated with the pain, then we would expect to see the pain in the upper limbs. Although these authors consider growing pains a condition that rarely occurs in the upper limbs, others do include arm pain in their definition of growing pains (Oberklaid et al., 1997; Oster, 1972b; Oster & Nielsen, 1972). In their argument against growth as an etiological explanation for growing pains, Atar and colleagues noted that 65% of growth occurs in

the distal femur and proximal tibia, but that only 20% of children seem to have pain localized in the knees. Further, they stated that children with growing pains show the same growth velocity as children without pain. However, children do not grow in a steady linear trajectory and it is possible that the pain might occur during brief bursts of accelerated growth.

Shrier, Ehrmann-Feldman, Rossignol, and Abenhaim (2000) conducted a prospective study to examine whether growth over a period of 12 months was related to the incidence of lower extremity pain in a cohort of 502 high school students (aged 12 to 18 years) selected based on grade level. The children's height and weight were measured at the beginning of the study, and then at 6 and 12 months. A high growth spurt was defined as having grown greater than 5 cm in a 6 month period. High growth was not a risk factor for development of pain. The authors also tested whether flexibility was a risk factor for pain and found that it was not. Flexibility was measured by using a goniometer for knee flexion range of movement in the prone position and for hamstring flexibility. A standard sit-and-reach box was used to measure toe-touch flexibility. Each child was assessed by the same physiotherapist or sport medicine physician at three time points.

Bennie (1894) stated that growth in the bones of the legs occurs more rapidly in the recumbent position. Therefore, he argued, if bone growth was the cause of the pain we would expect to see the pain occur at night rather than when children are up and about in the early evening. The theory of growth occurring while recumbent is supported by a study on growing pains by Noonan and colleagues (2004) suggesting that 90% of bone growth in lambs occurs while at rest, whilst almost no bone growth occurs during standing or while moving. If there is an association between growth and limb pain, it is

plausible that the pain is due to stress on pain-sensitive tissues such as the periosteum<sup>1</sup>, muscle, ligaments or tendons.

### **2.3.2 Fatigue**

The fatigue theory dates back to Bennie in 1894 who, based on his clinical observations, stated that myalgia<sup>2</sup> from fatigue of over-exertion was the most common variety of so-called growing pains. He noted that limb pain could be brought on by the inefficient elimination of waste products created when children had been active during the day. Additionally, pain could be brought on as a result of maintaining a particular position for a long time and, thereby, keeping the muscles contracted. Brown, in 1910, also observed that children with growing pains exhibited muscle stiffness and that the pain could be brought on by long periods of sitting or standing in only one position. Support for the fatigue theory comes from reports that growing pains is exacerbated by exercise (Naish & Apley, 1951) and by a single study demonstrating the effectiveness of a stretching intervention (Baxter & Dulberg, 1988). However, recent studies have found no evidence in support of a direct link between growing pains and activity level. Shrier and colleagues (2000) found no correlation between physical activity and lower extremity pain in adolescents aged 12 to 18 years. Their study, however, included adolescents with pain related to occupational activities and injuries, not just exercise. Evans, Scutter, Lang, and Dansie (2006) found no difference in parents' estimated ratings of activity level among children with growing pains compared to healthy children. The authors did not describe how activity level was defined.

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<sup>1</sup> Periosteum is a type of connective tissue covering the surface of a bone, with the exception of its articular cartilage. It has bone –forming potentialities.

<sup>2</sup> Myalgia is muscular pain.

Friedland and colleagues (2005) suggested that bone fatigue could be an explanation for growing pains. Bone speed of sound (SOS), determined by quantitative ultrasound, was measured in 39 children with recurrent childhood musculoskeletal pain (growing pains) who were living in Israel. Bone SOS is used to evaluate bone strength. Bone strength was significantly reduced in children with recurrent childhood musculoskeletal pain compared to healthy children, especially in the tibial region. There was no correlation between bone SOS and gender, duration of pain, frequency and location of pain, calcium intake, and level of physical activity. There was an association between increased SOS scores and higher body-mass-index percentile. There was also an association between Arab or Druze ethnic origin and increased bone SOS. The children with growing pains in this study also had lower pain thresholds (measured by dolorimeter pressure). The authors concluded that growing pains may represent an overuse syndrome characterized by bone fatigue in children. However, they also noted that this theory cannot explain why there are unexpected nocturnal pain episodes or why some children experience pain in the arms.

### **2.3.3 Psychosocial Problems**

In the first half of the 20<sup>th</sup> century Winnicott (1939) argued that growing pains was not a form of rheumatism. He considered growing pains to have a psychological origin in that it could result from states of anxiety and anger; Winnicott had observed growing pains as a feature in some children with depression. Winnicott believed that growing pains was “the dramatization of persecutions belonging to unconscious fantasy of what is inside the body.” (p. 43). To date there are no empirical studies that have investigated the psychogenic theory (i.e., that growing pains is a reaction to psychosocial problems). However, a few prevalence studies have included screening for psychosocial

difficulties. Naish and Apley (1951) found that a subgroup of children with growing pains who experienced pain during the day also experienced emotional disturbances, including irritability, nervousness, and fear of the dark. Apley (1976) suggested that children with diurnal growing pains might have “an underlying instability of the autonomic nervous system” (p. 490), expressed as a tendency towards emotional instability or general reactivity. Apley (1976) proposed that a family predisposition to pain, coupled with anxiety and emotional disorders, might render some children more vulnerable to limb pain triggered by faulty posture, physical exertion, school difficulties, and damp conditions.

Consistent with Naish and Apley’s (1951) findings, Cullen and MacDonald (1963) considered children with diurnal limb pain to be experiencing “the periodic syndrome” (a cluster of symptoms including headaches and abdominal pain) which was typically associated with psychological stress. Oberklaid and colleagues (1997) found that parents rated their children with growing pains as being intense, aggressive, anxious, and hyperactive, and having negative mood and overall behaviour problems, as compared to children who did not have growing pains. Although this trend met statistical significance it was of questionable clinical significance because the difference in means between the two groups was relatively small. Furthermore, teachers’ ratings of temperament showed no difference between children with growing pains and control children.

#### **2.3.4 Orthopedic Abnormalities**

In 1910, Brown commented that children with growing pains exhibited orthopedic problems including hyperextension of the knees, pronated feet, and poor



posture due to a weak spine and drooped shoulders. Consequently, children with growing pains experienced strain in the ligaments and inadequate protection of joints. Brown noted that the muscles and ligaments holding the sacrum are in constant contraction among children with growing pains and during sleep the sacrum moves, straining the sacro-iliac joints and causing pain in the legs or back. He recommended that children with growing pains would benefit from having a leather belt fastened around the pelvis to provide support to the pelvic girdle during the day and in some cases during the night. He also noted that some children might require a spring back brace earlier in treatment to provide support to the lower abdominal wall. Later the brace could be removed and children would need to engage in daily exercises in order to strengthen muscles and correct their postures. Hawksley, in 1939, also commented on an association between growing pains and flat foot (a condition in which the foot does not have a normal arch), knock knee (a condition in which the knees are abnormally close together and the ankles are spread apart) and poor posture. Apley (1976) noted that minor postural defects are more likely to be associated with diurnal pain and also can be associated with exertion. There is one experimental study, using a single case design (withdrawal A-B-A-B) with eight participants, which found that shoe inserts were an effective intervention (Evans, 2003). This study provides some support for the orthopedic theory. However, not all children with growing pains have anatomical abnormalities. A recent study found no clinically significant differences in foot posture between children with growing pains and healthy children aged 4 to 6 years (Evans & Scutter, 2007).

### **2.3.5 Chemical Imbalances**

Brown and colleagues (1998) noted that some researchers have speculated that growing pains is the result of a chemical imbalance including calcium, phosphorus, or potassium. Lech (2002) looked at hair levels of lead, copper, zinc, and magnesium in 173 children (aged 1-18 years) with “osteomuscular pains of unknown origin, once described as ‘growing pains’ ”(p. 111), and compared them with 108 healthy children. Lech found that children with osteomuscular pains of unknown origin had increased levels of lead (statistically significant) and of zinc (not statistically significant in younger children, but significant in adolescents) and decreased levels of copper (not statistically significant). Magnesium levels were decreased in younger children with osteomuscular pains of unknown origin (statistically significant for younger children up to 5 years), but increased in adolescents (over 15 years). The zinc/copper ratio of 17.9µg/g was significantly higher in the group of children suffering from rheumatic diseases compared to control children (15.6µg/g). Magnesium, zinc and copper play a role in metabolism. The magnesium/lead ratio (123µg/g) was significantly higher in the healthy children compared to the children with osteomuscular pains of unknown origin (78.3µg/g). Lech speculated that high lead levels accompanying magnesium deficiencies could be a cause of osteomuscular pains of unknown origin.

## **2.4 Intervention Studies**

Growing pains is commonly treated with heat, massage, and non-opioid analgesics. Uziel and Hashkes (2007) recommended the occasional use of a long acting analgesic for children with frequent night awakenings and for when parents expect their children to have a pain episode. Additionally, they suggested that increased calcium and vitamin D may be helpful, but acknowledged that there has been no research supporting this intervention. If Vitamin D insufficiency is related to growing pains one would

expect the condition to be more prevalent in children living in northern latitudes where there would be the least ultraviolet B exposure. Although there are insufficient prevalence studies originating from the southern hemispheric regions to examine potential regional and seasonal differences, a relatively high prevalence in Australia (Evans, 2004b; Oberklaid, 1997) and variability in prevalence rates across northern hemisphere regions (Abu-Arafeh & Russell, 1996; Hawksley, 1931; Naish & Apley, 1951; Oster & Nielsen, 1972; Seham & Hilbert, 1933; Williams, 1928) suggest that geography does not influence occurrence of growing pains. Vitamin D insufficiency, however, has been associated with musculoskeletal pain (Lee, 2006; Mascarenhas, 2004; McNally, Matheson, & Rosenberg, 2009) and, therefore, it is possible that in some children with growing pains vitamin D insufficiency might be a factor influencing both reduced bone density and limb pain.

Parents who seek medical advice are reassured that the child will outgrow the condition (Bowyer & Hollister, 1984; Macarthur et al., 1996). The extent to which recommended treatment ameliorates the pain, or to which parents and children are reassured by comments that the pain will be outgrown, is unknown. There is a paucity of intervention studies on growing pains; a search in PsycINFO and MEDLINE on December 16, 2008, restricted to English language publications, and using the keywords “growing pains” or “limb pain” and “treatment” or “intervention,” produced only two intervention studies.

Baxter and Dulberg (1988) conducted an experimental study to investigate the effectiveness of stretching in relieving growing pains. The intervention was based on the fatigue model, which suggested that growing pains could occur as a result of prolonged

muscle contraction. Thirty-six children aged 5 to 14 years were randomly assigned to either a treatment condition where stretches were prescribed daily, or to a control condition where parents were told to continue with their usual treatment of medications or friction rubs. Children completed a pain profile chart each week. Assessment of pain occurred monthly for the first 6 months and then every 3 months for a follow-up period of 12 months. The mean height percentile was 52% and the mean for weight was 48%. Growing pains was seen in both heavy and slim children, and in both tall and short children, suggesting that height and weight were not associated with the pain. The stretching group experienced a significant reduction in pain frequency compared to the control group. The authors reported that the stretching group spent extra time with their parents as a consequence of parental monitoring of the stretching and, therefore, parental attention may have influenced the results. Stretching may be a promising avenue for treatment and should be compared to placebo treatment (Baxter & Dulberg, 1988).

Evans (2003) followed 8 children (aged 3 to 10 years) who used an in-shoe orthotic device for pronated foot posture and aching legs. These children all met the inclusion criteria of intermittent, bilateral, late afternoon or evening pain with normal physical and laboratory findings. Baseline data included parents' ratings of the frequency of their child's leg pain as well as children's ratings of the intensity of their pain on the Wong-Baker FACES Pain Rating Scale. Observation of the foot posture was made by the clinician. The intervention commenced at least one week after baseline and an evaluation of the foot posture was made by the clinician two to three weeks after the intervention started. The in-shoe devices were removed when pain frequency or intensity decreased. Most of the children were reevaluated after two to three weeks of no

interventions, but evaluation occurred sooner if the pain became distressing. At the end of the intervention only one patient was not pain-free and this patient's symptoms had decreased in frequency. After withdrawal of treatment, symptoms returned in 7 out of 8 children. Among these 7 children, 5 experienced relief of symptoms once the shoe-insert was replaced. The other two children had reduced frequency and intensity of pain compared to baseline. Although this study was limited because of the subjective nature of evaluation by the clinician, it demonstrated preliminary support for shoe-inserts in the group of children with growing pains associated with pronated feet.

## **2.5 Association with Other Conditions**

Hashkes and colleagues (2004) suggested that "recurrent musculoskeletal pain, termed growing pains" (p. 610), may be a variant of a noninflammatory pain syndrome in younger children such as fibromyalgia. They measured the pain threshold, using a dolorimeter, in 44 children with recurrent musculoskeletal pain and 46 healthy children aged 4 to 12 years. Pressure was applied to points associated with pain in fibromyalgia, control points, and the anterior tibia (a common region of pain in children with growing pains). Children with growing pains had lower pain thresholds at all points compared to healthy children. Children with growing pains and healthy children had a higher pain threshold at the anterior tibia compared to the other points. The authors found no significant correlations between pain thresholds and length of the disease, frequency of pain, school absence, and medication use. The authors suggested that further studies should investigate whether children with growing pains develop other noninflammatory pain syndromes in adulthood.

Restless leg syndrome (RLS) is a condition characterized by an urge to move the legs, which is usually accompanied by uncomfortable sensations in the legs such as

burning, tingling and cramping (Picchietti et al., 2007; Walters, 2002). The following features of RLS are also common to growing pains: discomfort that is deep within the muscles; symptoms that are worse in the evening or at night; and relief obtained by rubbing the legs or use of analgesics (Walters, 2002). Ekbom (1975) distinguished growing pains from RLS by noting that growing pains can be exacerbated by running, but that pain from fatigue, such as RLS, may occur in children with or without excessive physical activity and disappears with rest.

Gamaldo and colleagues (2007) found that adults with RLS were no more likely to have had growing pains in childhood than healthy adults. However, among women, childhood growing pains approached significance as predicting RLS. A recent general population study found that children with RLS were more likely to have a history of growing pains compared to control children, though growing pains was common in both populations (Picchietti et al., 2007). The authors suggested that diagnoses of RLS were missed in some children initially presenting as having growing pains. Rajaram, Walters, England, Metha, and Nizam (2004) found that among 11 children previously diagnosed with growing pains, 10 met criteria for RLS and not growing pains. The sample was selective in that children were referred by a pediatric neurologist familiar with RLS, but the study does indicate that some children with RLS are misdiagnosed as having growing pains. The criteria for the previous diagnoses of growing pains were not described. Walters and colleagues (1996) found that misdiagnoses among children with young-age onset RLS (under 20 years) included growing pains. In some cases, children were told they had growing pains by their families. Growing pains is more common in children with early-onset restless leg syndrome (less than 20 years) compared to children

with late-onset restless leg syndrome (Bassetti, Mauerhofer, Gugger, Mathis, & Hess, 2001). Walters (2002) proposed that research should be done to determine if children with growing pains later develop RLS.

## **2.6 Impact of Growing Pains**

Very little is known about the impact of growing pains on children. Because the pain is intermittent, and believed to be brief (i.e. lasting from minutes to hours; Uziel & Hashkes, 2007), it is assumed that there are no lasting consequences of having the pain. Although growing pains is a benign condition, in that it does not lead to future musculoskeletal or rheumatic disease, we cannot assume that the experience of pain is benign. Children with chronic pain (including limb pain) have reported a negative impact of pain on their quality of life (Hunfeld et al., 2001). Furthermore, mothers have reported burdens associated with caring for a child with chronic pain, such as restrictions on social life and stress (Hunfeld et al., 2001). In a survey of parents of children aged four to six years with growing pains, 5.7% of parents estimated a reduced quality of life for their children (Evans et al., 2006). Many other parents reported that they were “uncertain” as to whether quality of life was affected, yet they did rate their children as having difficulties in functioning including with sleep and activity. Based on their clinical experience, Uziel and Hashkes (2007) commented on the impact of growing pains: “frequent episodes may have a major impact on the child and his family’s daily routine, including absences from school and work, daytime fatigue, reduced physical activity and frequent or chronic use of pain relief medications.” Growing pains is a condition that typically occurs in the evening or during the night, and yet no research has examined the impact of growing pains on sleep. We do not know the long-term impact of having growing pains. It is possible that children with more intense and frequent pain, as well as

children with poor coping skills, may experience distress related to having this pain. As a result of poor coping, it is possible that these children may also be at risk for developing a chronic pain syndrome in adulthood. Uziel and Hashkes (2007) suggested that cognitive behavioural therapy may be warranted if it is shown that children with growing pains develop other pain syndromes later in life.

Growing pains affects not only children, but parents who have the responsibility of helping their children manage their pain. Uziel and colleagues (2007) evaluated the quality of life of parents of children with growing pains. Parents of children with growing pains had similar quality of life and anxiety scores compared to parents of children without pain. Mothers of children with growing pains had slightly elevated depression levels compared to mothers of healthy children. Given that the measure of depression used contained only six items (assessing both anxiety and depression), and that the measure was originally developed to assess functioning in patients with arthritis (Meenan, Mason, Anderson, Guccione, & Kazis, 1992), these results do not provide support for the presence of clinical depression in mothers of children with growing pains.

## **2.7 Conclusions and Directions for Research**

There are no universal diagnostic criteria for growing pains. Furthermore, we do not know if growing pains is a variant of other conditions, such as restless leg syndrome or fibromyalgia, or whether children with growing pains are at risk for developing restless leg syndrome or fibromyalgia in adulthood. Based on his observations, Weiner (1983) reported that adults with degenerative joint disease often recall having growing pains. Similar observations have been made regarding adults with fibromyalgia. However, there have been no longitudinal studies to examine whether



children with growing pains are at an increased risk of developing pain conditions in adulthood. It is possible that there may be subgroups within growing pains and children with particular features may be at greater risk for pain in adulthood. For example, growing pains associated with orthopedic abnormalities may form a subgroup and children within this group might benefit from physiotherapeutic, orthopedic or podiatric assessment and treatment. A conceptual model of growing pains would clarify factors associated with the condition and outline unique features associated with subgroups. Once the population has been defined, research needs to be conducted to determine risk factors for developing growing pains and risk factors associated with having growing pains, including potential functional limitations and related psychosocial factors. Additional research is needed to determine whether children with particular features benefit from tailored treatment approaches. A clear definition of growing pains and a model of factors associated with the condition will provide direction for researching the most effective methods for helping children manage the pain and associated symptoms.

## CHAPTER 3 SURVEY OF HOW PHYSICIANS DEFINE AND DIAGNOSE GROWING PAINS

### 3.1 Introduction

#### 3.1.1 Definition and Diagnostic Criteria

Growing pains can be a challenging diagnosis for physicians because there is no common definition or universal diagnostic criteria for this pain. A definition should include the necessary features of a condition, which also constitute diagnostic criteria. Exclusionary criteria are not included in a definition. A number of reviews on growing pains describe it as a diagnosis of exclusion (Al-Khattat & Campbell; Doughty, 1988; Halliwell & Monsell, 2007). Anecdotal reports by physicians vary widely in the description of growing pains. There are also discrepancies in inclusion and exclusion criteria used across prevalence studies. For example, some studies include children with daytime limb pain (Oberklaid et al., 1997), whereas others define growing pains as typically nocturnal and, therefore, exclude children with early morning pain (Evans & Scutter, 2004a, 2004b). A number of authors have specified three to twelve years as the typical age range during which growing pains occurs (Doughty, 1988, Foster et al., 2008; Uziel & Hashkes, 2007). However, in many prevalence studies the age that was sampled was restricted and children younger than five years have typically not been included (Abu Arafah & Russell, 1996; Evans & Scutter 2004a; Naish & Apley, 1951).

Compounding the problem of definition and diagnosis is the absence of an etiological explanation of growing pains. There is no evidence fully supporting any of

the four main causal theories of growing pains: growth, fatigue, psychosocial disturbances, and orthopedic abnormalities. The role of biochemical imbalances in the etiology of growing pains is also unclear. There appears to be an association between growing pains and restless legs syndrome (Picchietti et al., 2007). Haskhes and colleagues (2004) found that children with growing pains have more tender points and lower pain thresholds than healthy children, indicating that growing pains could be a type of noninflammatory pain syndrome. Whether growing pains shares an etiology similar to restless legs syndrome or fibromyalgia is unknown. Subgroups of growing pains have been described based on differences in proposed etiological factors (Naish & Apley, 1951; Sheldon, 1951). An etiological explanation may shed insight into the question of whether there are subgroups of growing pains. Additionally, an etiological explanation may shed insight into whether or not to include upper limb pain and daytime pain as exclusion criteria.

In some cases, diagnostic tests are ordered to rule out other possible explanations for presentations of limb pain that appear to be growing pains. There is variability in the types of diagnostic tests (hemoglobin level, erythrocyte sedimentation rate, blood cell counts, radiograph, and bone scans) used by physicians when a child has pain in the legs (Macarthur et al., 1996). Family physicians are more likely to order tests of hemoglobin levels, erythrocyte sedimentation rate, and blood cell counts, as compared to pediatricians, pediatric orthopedic surgeons and pediatric rheumatologists (Macarthur et al., 1996). In a survey study of physicians, Macarthur and colleagues (1996) found that 58% of physicians were more likely to order tests for children older than 12 years. This could have been associated with physician beliefs about the typical age range of

occurrence of growing pains. In addition, physicians were more likely to order tests when parents were concerned about the pain and when the child had repeated visits because of the pain (Macarthur et al., 1996). The authors suggest that diagnostic tests and the act of testing are also used to reassure parents, children, and physicians, that there is no organic disease and that the child does actually have growing pains.

### **3.1.2 Presentation to Physicians**

Children with growing pains are most likely to present to family physicians or pediatricians, and subsequently, may be referred to rheumatologists (Rosenberg, 1990) or orthopedic surgeons (Dietz, Mathews & Montgomery, 1990). In a survey study of physicians at the Hospital for Sick Children in Toronto, Ontario, Macarthur and colleagues (1996) found that the median proportion of office visits due to growing pains was 2% for pediatric orthopedic surgeons and pediatric rheumatologists combined and 1% for pediatricians and for family physicians. It was noted that given the number of visits to primary care physicians, referral rates, and diagnostic testing, growing pains is a significant health care burden.

### **3.1.3 Purpose of this Study**

Given the variability in diagnostic criteria for growing pains, the purpose of this phase of the current research was to develop a definition of growing pains based on commonalities described by physicians, which could be used in selecting a research sample. A secondary purpose was to identify any potential causal factors or pain management techniques as described by physicians, which could be avenues for further research. Ethical approval for the study was obtained from the University of Saskatchewan Behavioural Research Ethics Board (see appendix A).

## **3.2 Method**

### **3.2.1 Participants and Procedure**

A survey on growing pains was sent to a stratified random sample of 279 English speaking physicians across Canada. Aspects of Dillman's (2000) tailored design method for mail and internet surveys were utilized in developing the survey procedure. The number of physicians surveyed in each discipline was limited by the number of English speaking members of The Royal College of Physicians and Surgeons of Canada within each discipline. The sample was obtained from member lists provided by The College of Family Physicians of Canada and The Royal College of Physicians and Surgeons of Canada, as well as from a list of pediatric rheumatologists. In the case of family physicians, where there were over 19,000 members of the college, stratified and systematic sampling methods were used to select 70 members. The survey was mailed with a cover letter (see appendix B) to family physicians ( $n = 70$ ), pediatricians ( $n = 64$ ), pediatric rheumatologists ( $n = 25$ ), rheumatologists ( $n = 55$ ), and orthopedic surgeons ( $n = 65$ ). Physicians had the option of returning the survey via mail in the stamped envelope provided or responding online. A reminder postcard (see appendix C) was sent one week after the survey was mailed. The final sample consisted of 88 participants: 19 family physicians, 28 pediatricians, 20 pediatric rheumatologists, 8 rheumatologists, 13 orthopedic surgeons.

### **3.2.2 Measure**

The initial version of the survey was developed after careful review of the literature on growing pains. The survey was piloted with pediatric residents at the Royal University Hospital Saskatoon and the survey was revised based on the pilot and on

feedback from experts in the field (a pediatric rheumatologist and a community physician).

Open-ended questions were utilized in order to obtain the full range of characteristics used to define and diagnose growing pains. Macarthur and colleagues (1996) had noted that a limitation of their survey study on the diagnostic tests used by physicians was that physicians were provided with a list of options rather than open-ended questions.

The following four content areas were surveyed: (1) use of the term growing pains and alternative terms; (2) definitions of growing pains; (3) diagnostic criteria; and (4) potential subgroups of growing pains. In addition, demographic information on medical specialty of participants and the number of years in medical practice were obtained. The survey is presented in Appendix D. An online version of the survey was available at <http://tinyurl.com/326of> (accessed October 22, 2008).

### **3.3 Results**

Of the 279 physicians who were invited to participate in this study, 13 were ineligible, either because they did not see children in their practice and, therefore, did not complete the survey ( $n = 11$ ), or because of an incorrect mailing address ( $n = 2$ ). Of the remaining 266 physicians, 88 responded, yielding a respectable response rate of 33%. Only 5% ( $n = 4$ ) of the participants responded online. The response rates for the various groups were as follows: 27% ( $n = 19$ ) of family physicians, 44% ( $n = 28$ ) of pediatricians, 80% ( $n = 20$ ) of pediatric rheumatologists, 15% ( $n = 8$ ) of rheumatologists, and 20% ( $n = 13$ ) of orthopedic surgeons. The median number of years in practice was 19 with a minimum of 4 and a maximum of 50.

### 3.3.1 Use of the Term Growing Pains

Of the 86 physicians that answered the question, “do you use the term growing pains?” 77% (n = 66) used the term. Table 3.1 shows a breakdown of use of the term by physician group.

Table 3.1 Percentage (number) of Physicians Using the Term Growing Pains (n = 86)

Pediatricians (n = 26)	Family Physicians (n = 19)	Pediatric Rheumatologists (n = 20)	Rheumatologists (n = 9)	Orthopedic Surgeons (n = 13)
88% (23)	58% (11)	85% (17)	78% (7)	54% (7) <sup>a</sup>

<sup>a</sup> one physician answered yes and no, seven answered yes, and five answered no

Chi-square analyses compared the use of the term between pediatricians, family physicians and all rheumatologists (the pediatric rheumatologist group was combined with the general rheumatologist group). The orthopedic surgeons were not included in this analysis because of the small number of participants in this group. A two-way Chi-Square analysis with physician specialty (pediatrician, family physicians, all rheumatologists) and use of the term (yes or no) as variables, showed there was a significant difference between the use of the term growing pains among physicians  $\chi^2_{0.05}(1, N = 74) = 6.592, p = 0.037$ . A likelihood ratio test showed that pediatricians are more likely to use the term as compared to family physicians: likelihood ratio = 5.593,  $p = 0.018$ , but that they are not more likely to use the term as compared to rheumatologists: likelihood ratio = .363,  $p = .547$ .

### 3.3.2 Appropriateness of the Term Growing Pains

Of the 82 physicians who answered this question, 30% (n = 25) said that growing pains is an appropriate term and 65% (n = 53) said that it is not. Of the physicians that answered the question on appropriateness of the term, 2.4% (n = 2) did not know whether or not it is an appropriate term and 2.4% (n = 2) answered both yes and no. Table 3.2 shows a breakdown of use of the term by physician group.

Table 3.2 Percentage (number) of Physicians Who Consider the Term Growing Pains Appropriate

Pediatricians (n = 23)	Family Physicians (n = 19)	Pediatric Rheumatologists (n = 20)	Rheumatologists (n = 8)	Orthopedic Surgeons (n = 12)
17.3% (4)	47.4% (9)	25% (5)	50% (4)	25% (3)

A chi-square analysis was used to compare beliefs about the appropriateness of the term growing pains between pediatricians, family physicians and all rheumatologists (the pediatric rheumatologist group was combined with the general rheumatologist group). The orthopedic surgeons were not included in this analysis because of the small number of participants in this group. A 3 x 2 chi-square analysis showed there was no significant difference between considering the term growing pains appropriate among the physicians  $\chi^2_{0.05} (2, N = 66) = 4.542, p = 0.103$ .

Of the 66 physicians who use the term growing pains, only 37.8% (n = 25) consider it to be an appropriate term. Reasons given for stating that growing pains is an appropriate term clustered into four categories: (1) people are familiar with the term (e.g., “parents are familiar with it and feel reassured”), (2) the term conveys that it is a benign



condition, (3) the condition is associated with growth, and (4) the term is appropriate under certain conditions (e.g., “only if no other injury can be found”).

Reasons given for stating that growing pains is not an appropriate term fell into two categories: (1) diagnostic concerns (e.g., “it is a grab bag definition that may cause mistreatment of conditions”), and (2) the term is a misnomer and does not describe causal factors (e.g., “growth itself is not really a cause of the pain”).

### **3.3.3 Suggestions for Alternative Terms**

The most commonly used terms as a substitute for growing pains were “benign nocturnal pains of childhood” (used by 5 physicians) and “recurrent limb/leg pain” (used by 5 physicians). One physician noted that recurrent limb pain is often a diagnosis confused with growing pains rather than an alternative term for growing pains. In other words, the term recurrent limb pain is not specific to the entity “growing pains” and for example, is also used to refer to malalignment issues.

Other terms that were used by only one respondent each included: innocent limb pain, idiopathic limb pains of childhood, paroxysmal nocturnal limb pains, night limb pains of childhood, “overuse” discomfort pains of childhood, inflammation due to strain/spasm, physiologic bone development, epiphyseal/growth plate pain, overuse strain or pains related to specific problems of joints and ligaments, and muscular pain.

### **3.3.4 How do Physicians Define and Diagnose Growing Pains?**

Physicians were asked to provide a definition of growing pains and to specify any diagnostic criteria. Physicians typically defined growing pains by the location of the pain (see Table 3.3), the intermittent and transient nature of the pain, and the time of day that the pain occurs (see Table 3.4). A few physicians included a description of etiology in their definitions (e.g. “often active play without injury,” “stretching of the periosteum and

perhaps adjacent tendons of the tibia in children during their growth spurts.” Words used to describe the quality of the pain were dull, deep ache or aching, deep cramping character, and discomfort. Twenty physicians stated that part of the diagnosis includes a normal exam and/or no objective findings. This included absence of the following symptoms: cramp, fever, increased heat, swelling, marked tenderness, bruising or redness, inflammation, limping, or functional disturbance. Some physicians also included an age range as part of the diagnostic criteria. Others noted the typical age at which growing pains tends to occur. Figure 3.1 shows the age range described by physicians. Five physicians specifically stated that there are no validated diagnostic criteria.

Three physicians noted that growing pains is not an actual condition and one stated that growing pains represents a symptom cluster and not a definite syndrome. Two orthopedic surgeons stated that growing pains is not a diagnosis, but provided lists of defining features.

Table 3.3 Locations of Growing Pains

Location of pain	Number of physicians
Leg or lower limb (including tibia or shin, thigh, calf, knee, ankle, and foot)	43
Limb (no specification of upper or lower)	9
<sup>a</sup> Upper limb and lower limb	1
Laterality	
Can be unilateral or bilateral	5
Bilateral only	2
Localized	2
Diffuse/not well localized	4
Joints involved	3
Not joint/ non-articular musculoskeletal	10

<sup>a</sup>Only one physician mentioned upper limb pain, but stated that the pain occurred most frequently in the lower limbs. When answering the question on subgroups, 3 physicians mentioned that there are children who have arm pain (not all of them considered this a subgroup). Another physician mentioned that there may be children who have arm pain, but that including this as a diagnostic criterion increases the risk of misdiagnosis.

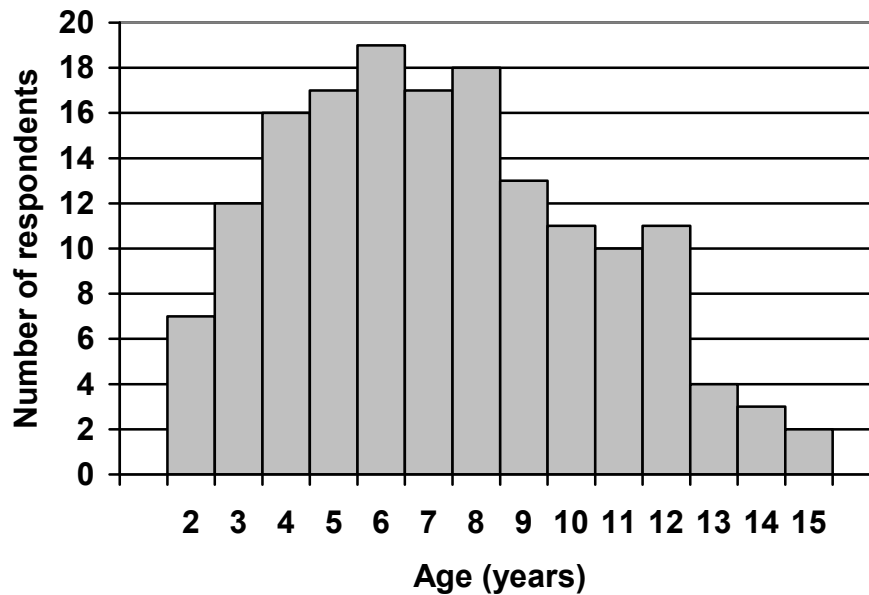
Table 3.4 Time of Day that Growing Pains Occur

Time of day	Number of physicians
Evening/night	<sup>a</sup> 44
May awaken child from sleep	7
Does not wake child	1
Resolved by morning	9
Occasionally occurs in the day	<sup>b</sup> 2

<sup>a</sup>Of these, 23 physicians said usually or almost always, 4 said the pain only occurs in the evening/night and 3 said that the pain is worse at that time of day.

<sup>b</sup>An additional 3 physicians noted that the pain can occasionally occur in the day, but did not include this as part of the definition or diagnostic criteria.

Figure 3.1 Frequency of Typical Age Ranges of Growing Pains Occurrences



Histogram of the ages included in the age range specified as part of diagnostic criteria. It is important to note that some physicians specified peak age ranges and noted that the condition does occur outside of that range. This allows for the possibility that the condition occurs in adolescents older than 15. In fact, two physicians noted that the condition can occur in adulthood.

### 3.3.5 How is Growing Pains Managed?

A number of physicians identified ways of managing growing pains in their definition of the condition. Five ways of managing growing pains were mentioned: use of analgesics, massage, reassurance, heat, and rest. Table 3.5 shows the number of physicians that mentioned each approach. There was no mention of exercise or stretching as a preventative pain management technique.

### 3.3.6 Factors Associated with Growing Pains

Across all specialties physicians had discrepant opinions as to the cause of growing pains. While 10 physicians from all specialties noted that the pain is associated with growth, 24 stated either that the pain is not related to growth or that there is no evidence to suggest that it is. Eleven physicians noted that the pain is associated with

increased activity. One physician, with a specialty in pediatrics, suggested that the pain is associated with a weight bearing imbalance<sup>1</sup>.

Table 3.5. Treatment for Growing Pains

Methods of managing growing pains	Number of physicians
Analgesics (acetaminophen, NSAIDS, or unspecified)	10
Massage/rubbing	9
Consoling	3
Heat	2
Rest	2

### 3.3.7 Are there Subgroups of Growing Pains?

Sixty-eight physicians (77%) did not consider there to be subgroups of growing pains, that is, features that distinguish among children. A few physicians noted that there is variability in symptom presentation and that some children do have arm pain and daytime pain, but that they would not necessarily consider these children to fit into a subgroup.

Ten physicians (11%) did consider there to be subgroups. The possible different groups included: children who have recurrences depending on activity level versus those

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<sup>1</sup> Weight bearing imbalances are uneven distributions of weight in the feet upon contact with the ground and can cause pain in the limbs as well as in the hips and back. Pronated feet, for example, would cause a weight bearing imbalance.

who do not, children who have pain in the arms versus the legs, children who have pain in the daytime versus nocturnal pain, children who have sleep difficulties and are overtired, children whose pain is reinforced by a parent with chronic pain, and children who have a low pain threshold.

### **3.4 Discussion**

The current results highlight the variability in clinical descriptors of growing pains. Differences among physicians included the age at which growing pains tends to occur and the type of symptoms experienced, including pain in the joints versus in the muscles and pain that occurs both during the day and the night versus nighttime only pain. Some physicians specified an age range they use in diagnostic criteria for growing pains, whereas others either did not specify an age or did not use age as a diagnostic criterion. The overall age range of occurrence of growing pains, described by those physicians who specified an age as part of the definition, included children from 2 years to 15 years. The peak age range described by physicians appears to be 3 to 12, which is consistent with the existing anecdotal literature (Doughty, 1988, Uziel & Hashkes, 2007) and clinical practice guides (Foster et al., 2008). It is important to note that the current study indicates that the age range is not limited to children aged 3 to 12 years and, therefore, this range should not be used as a diagnostic criterion. It is recommended that the qualifier “typical” be used in delineating the age range for practice guidelines. A few physicians commented that there does not appear to be any scientific basis to consider growing pains a discrete condition. However, growing pains is clearly distinguished in its typical symptom presentation from other types of recurrent limb pain (see Figure 1.1).

Despite the variability in the descriptions of growing pains, most physicians tend to conceptualize growing pains as pain that occurs in the lower limbs in the early evening

or at night-time. A few physicians considered the possibility that this is the most common form of growing pains, but that other subgroups of growing pains might exist that include children who experience daytime pain in addition to night-time pain. These results are consistent with those of Apley (1976) who found that two-thirds of children with limb pain with no organic disease experienced pain in the daytime or evening. Only one physician specifically included arm pain in the definition, specifying that leg pain also had to be present. A few other physicians noted that they do see children who have arm pain in addition to limb pain, but did not state this as a defining factor. Among those physicians who consider there to be subgroups of growing pains, factors that divided children into groups were recurrences depending on amount of activity, pain in the arm versus the legs, and pain in the daytime versus nocturnal pain, children who have a low pain threshold, children whose pain is reinforced by having a parent with a chronic pain syndrome, and children who have sleep disturbances and are over tired. Some physicians referred to increased play activity in their definitions of growing pains and, therefore, it is likely that a group whose pain is associated with activity level would include children with increased activity versus those with limited activity.

Based on the information provided, the key criteria for selection of homogenous samples of research participants appear to be: (a) leg pain and (b) nocturnal pain. Some children also have daytime pain and arm pain. These children could be included in a heterogeneous sample of growing pains and, depending on the research question, children with symptoms of arm and daytime pain could be compared to children with the more typical symptoms of nocturnal lower limb pain. In addition, children should be eligible only if there are no objective signs such as swelling or tenderness. Other features of the



condition, such as whether the pain is bilateral or how easily it can be relieved, may be important to consider in defining criteria for inclusion. Children with unilateral pain could be experiencing a condition other than growing pains.

When a child presents with limb pain of unknown etiology physicians have to determine whether there is a need for further testing or whether the pain is growing pains. There are no significant differences between laboratory tests given to children with growing pains compared to control children (Asadi-Pooya & Bordbar, 2007), indicating that children with growing pains should have normal laboratory results. If classic signs of growing pains are not present, Macarthur and colleagues (1996) suggested that physicians use diagnostic tests such as erythrocyte sedimentation rates, blood cell counts, and radiographs to rule out conditions other than growing pains. The current study suggests that classic signs of growing pains are pain in the lower limbs occurring intermittently and at night. The results of the current survey suggest that perhaps physicians typically do not use diagnostic tests for excluding growing pains in typical cases -- very few physicians actually mentioned diagnostic tests. Rather, physicians look for signs, such as swelling and increased heat in a physical exam, which would be indicative of a condition other than growing pains.

Interestingly, only 38.4% of physicians that use the term growing pains considered it to be an appropriate term. The most common reasons that physicians use the term appears to be that they consider it reassuring to parents and children. However, we do not actually know how parents and children interpret the term. That is, do parents and children consider growth to be a cause of the pain and if so is this reassuring for them? Pediatricians were more likely to use the term growing pains compared to family

physicians. This could be related to a difference in training or to comfort with using the term based on knowledge of other rheumatic conditions in children. A survey in the United Kingdom indicated that trainees in primary care reported low self-confidence with their skills in diagnosing and managing musculoskeletal problems (Boyd et al., 2007).

A number of alternative terms were suggested, the most common being benign nocturnal pains of childhood and recurrent limb/leg pain. Both of these terms avoid implicating causal factors. However, recurrent limb pain is a term that is used to describe other recurrent limb pains and not just growing pains. For example, it includes pain caused by arthritis and pain caused by malalignment. A possible alternative term that could be used is recurrent idiopathic limb pain of childhood. Use of the word idiopathic distinguishes episodic pain of unknown etiology from recurrent pain with a known cause. Recurrent idiopathic limb pain is a fairly broad term in that it could be used for indicating children who also experience arm pain or daytime pain. For some children the pain may be related to conditions such as flat feet. More specific labels, such as recurrent idiopathic limb pain associated with postural abnormalities, could be added to the basic classification of growing pains. Although the term “recurrent idiopathic limb pain” is specific, and avoids implying knowledge of etiology, it is not a term that would be easily understood by children and individuals outside of the medical community. Parents may find the term confusing. Furthermore, unlike the term “growing pains,” the term “recurrent idiopathic limb pain” does not convey reassurance that the pain is not indicative of a serious illness. Continued use of the term growing pains is recommended as a label for the condition in communication with parents and children.

Consistent with physician anecdotal reports (Halliwell & Monsell, 2001; Homeier et al., 2004), physicians in this survey recommend analgesics, heat, massage, and reassurance as management strategies. Two physicians also recommend rest; the reasoning behind this strategy would be consistent with the fatigue theory of growing pains (i.e., pain occurs because of muscle fatigue; Bennie, 1894). It is important to note that there have been no studies examining the effectiveness of any of these pain management strategies. It would be beneficial to know whether these strategies (analgesics, heat, massage, rest) result in quicker pain reduction if implemented immediately upon onset of the pain versus implementation some time after the pain has started. Also, we do not know how reassurance helps in coping with the pain, if at all. None of the physicians in this survey mentioned stretching as a possible intervention. One of the only two intervention studies on growing pains indicated that stretching could be an effective intervention (Baxter & Dulberg, 1988). With regard to possible etiology, a few physicians in this survey suggested that increased activity is associated with growing pains. This has also been noted by Apley, (1976) and fits with Bennie's fatigue theory (1894). Also, children have identified tiredness as a triggering factor for growing pains (Abu-Arafeh & Russell, 1996). However, we do not know if their fatigue is related to increased activity.

The current survey had a number of limitations. First, although an open-ended questionnaire format was important because it allowed us to obtain the full range of characteristics used to define and diagnose growing pains, it is possible that some physicians did not spontaneously list all the characteristics they use in defining growing pains. Because the questionnaire was designed to be open-ended, statistical analyses and

frequency counts were used solely to provide an indication of the most common features spontaneously stated by physicians when defining growing pains. Secondly, orthopedic surgeons could not be included in the analysis of differences among the physician specialties because of the low response rate. Finally, with regard to use of the term growing pains, the questionnaire did not ask how these alternative terms are used (e.g., are they used with patients, with patients' parents, in correspondence with colleagues).

Speculations by physicians regarding the possible etiology of growing pains suggest avenues for further research. For example, what is different about children who experience onset of the pain related to increased activity versus those who do not? Is a weight bearing imbalance a feature for all children with growing pains, or would this constitute a possible subgroup of children? Research is also needed to determine the effectiveness of recommended management strategies.

## CHAPTER 4 RISK FACTORS ASSOCIATED WITH GROWING PAINS

### **4.1 Introduction**

The purpose of phase two of the research was to identify potential risk factors associated with growing pains and to identify common characteristics among patients with the condition. There is anecdotal evidence in the literature that growing pains is associated with a history of other recurrent pains (Oster & Nielsen, 1972) and damp living or environmental conditions (Naish & Apley, 1951). Apley (1976) suggested that nocturnal limb pain can be associated with wet or cold weather. There is growing evidence that growing pains is associated with a family history of the condition (Apley, 1976; Evans & Scutter 2004a). Because there have been no empirical studies looking at potential risk factors for growing pains, the approach to this phase of the research was to explore a variety of the following types of variables that could potentially be associated with growing pains: parental factors, birth and developmental factors, history of illnesses including the family history, school functioning, and living environment.

### **4.2 Method**

#### **4.2.1 Participant Selection**

A rheumatology database collected over a period of 20 years (1983 through 2003) was analyzed using bivariate statistics and logistic regression modeling. The dataset was collected at the Pediatric Rheumatology Clinic, University of Saskatchewan, Saskatoon, Saskatchewan, and comprised data on 3000 children referred because of a

suspected rheumatic condition. All of these children received a diagnosis from the same rheumatologist. Among the 3000 pediatric patients, 69 (2.3%) had a diagnosis of growing pains. In addition to growing pains, 104 other diagnostic categories were represented in the database.

During the index visit, usually the child's first visit to the rheumatology clinic, parents completed a "Pediatric Rheumatic Disease Questionnaire" designed by Rosenberg and Bingham in 1982. The questionnaire included demographic information, description of the child's symptoms based on parent report, family history including history of illnesses, the mother's obstetric history, the child's developmental and school history, the child's history of immunizations and previous illnesses, and information on the family living environment. Parents of children with rheumatic conditions were asked to invite parents they knew with healthy children to complete the questionnaire. A total of 877 parents of children without a rheumatic condition filled out the questionnaire to yield a sample of control children.

Children with growing pains were compared to control children in order to determine features that differentiate children with growing pains from healthy children. A matched control sample was created by computing the age of the children at the index visit to the clinic. Each child with growing pains was matched to a child from the control group closest in age (days). Children with growing pains were also compared to children with juvenile idiopathic arthritis of the oligoarticular type (pain in four or fewer joints) to determine features that differentiate growing pains from pain associated with rheumatic disease. Each child with growing pains was matched to a child with JIA closest in age

(days). Ethical approval for data analyses was obtained from the University of Saskatchewan Behavioural Research Ethics Board (see appendix A).

#### **4.2.2 Bivariate Analyses**

All analyses were performed using SPSS for Windows version 14 (SPSS Inc., Chicago, IL). Exploratory analyses were carried out using bivariate statistics to determine whether children with growing pains differed from other children (children without pain and children with juvenile idiopathic arthritis) with regard to the mother's experiences during the pregnancy, parents' marital status, age at which developmental milestones were met, temperament, school functioning, illness experience, illnesses in the family, and living environment. The sign test for two related samples was used when the variable was dichotomous. The sign test was chosen because it does not make any assumptions about the form of the distribution and does not assume that all participants are from the same population (Siegel & Castellan, 1988). Furthermore, unlike the McNemar test, the sign test does not test for the significance of changes, making it an appropriate test for use with dichotomous variables. The sign test examines the direction of differences between each pair. Under the null hypothesis one would expect approximately half of the differences to be negative and half to be positive (Siegel & Castellan, 1988):

$$p(X_A > X_B) = p(X_A < X_B) = \frac{1}{2}$$

where  $X_A$  and  $X_B$  are the two scores for a matched pair

When data for a variable were ranked, the Wilcoxon matched-pairs signed ranks test was used. This test considers the magnitude of the difference as well as the direction of differences (Siegel & Castellan, 1988).

### 4.2.3 Multiple Logistic Regression

All analyses were performed using SPSS version 14 (SPSS Inc, Chicago, IL). Logistic regression is a statistical technique that models the relationship between an outcome variable (in this case growing pains) and a set of predictor variables (Hosmer and Lemeshow, 2000). It is used when the outcome variable is dichotomous. The sample for the logistic regression analysis consisted of 69 children with growing pains, and, age and gender matched controls. It is important to note that the sample was not a matched-pairs sample, but was group matched because of a significant difference on age between the control sample and the growing pains sample, which would have introduced statistical estimates that were biased.

In order to determine the variables to include in the logistic regression, the variables were first grouped theoretically, resulting in 111 variables falling in the following categories: Birth related and parental variables, developmental milestones, temperament, school related variables, child illnesses, illnesses in the family, and living environment. The number of variables was reduced to 31 by selecting those variables that were of clinical interest (pain conditions in the family, gender) and those variables that were significant in bivariate odds-ratio analyses. Gender was included as a test, and was expected to be nonsignificant as gender matched controls were selected. The number of variables was then reduced to 20 by selecting those variables that had a significant univariable analysis (i.e.,  $p < .25$ ) based on criteria suggested by Hosmer and Lemeshow (2000), as well as variables that were of clinical interest. The variables were screened for multicollinearity, and those variables with a variance inflation factor greater than 10 were removed, further reducing the number of variables to 17. Logistic regression modeling was attempted, but proved unsuccessful. Therefore, the variables were screened further,



and those that had problems such as missing data and low cell frequencies were removed from the analysis, yielding 12 variables for further analysis. Logistic regression modeling techniques were attempted again, but were unsuccessful. It was determined at this point that the modeling technique was unsuccessful because of a large variable to case ratio and that the data allowed for only 4 variables (i.e. ratio of 10 cases to 1 variable). The greater the number of variables that are included in the model the greater the estimated standard errors (Hosmer & Lemeshow, 2000). Various combinations of models with 4 to 6 variables were analysed. Because there was no theory guiding the data analysis, stepwise regression (backward and forward) was determined to be most suited to the data. Elimination of variables at each step was based on the likelihood ratio test at a 10% level of significance and probability for stepwise entry was at a 5% level of significance. Exploratory modeling was also conducted using the enter technique, whereby variables were entered into the model in a specific order. This technique yielded the same results as stepwise modeling and there was no difference in predictors that fit using either forward or backward stepwise techniques. Results are presented based on values obtained in backward modeling.

### **4.3 Results**

#### **4.3.1 Descriptive Information on the Children with Growing Pains**

There were 39 females (56.5%) and 30 males in the sample (43.5%) ranging in age from 2 to 10 years at the index visit. The mean age at the index visit was comparable for females and males – 4.7 and 4.8 years respectively. The age of onset of pain ranged from before the first birthday to seven years of age. However, the onset age was missing for nearly half of the sample. These missing data are likely a reflection of the insidious onset of the condition, which makes it difficult to identify a precise onset time. Table 4.1

shows the frequency of age of onset. Most of the children in the sample were Caucasian. Table 4.2 shows the ethnicities of the children with growing pains.

There were more patients diagnosed with growing pains per year from the mid nineties to the late nineties than in other years. Interestingly, with the exception of two patients, all the other patients for whom data were available ( $n = 27$ ) came to the clinic within two years of onset of the pain. The two patients who were the exception came to the clinic within three years of onset of the pain. Figure 4.1 shows the percent of new patients with growing pains that were seen each year.

#### **4.3.2 Parents' Comments about their Child's Condition**

Parents were asked the following two questions about their child's condition: (1) In your own words what are the main features of your child's conditions?; and (2) In your own words what are your main concerns about your child? Of the 69 parents of children with growing pains, 39 commented on one or both of these questions. Table 4.3 shows the number of parents who commented on specific locations of pain when describing their child's condition. Most of the children experienced pain in the legs. However, some children also experienced pain in the arms, hands or wrists. All the children who had pain in the arms, hands, or wrists, also had pain in the lower limbs. Twelve parents commented that their children experienced the pain at night. Only one child was described as having day and night pain. Table 4.4 shows the number of parents who used particular sensory descriptors to describe the sensation their child was experiencing.

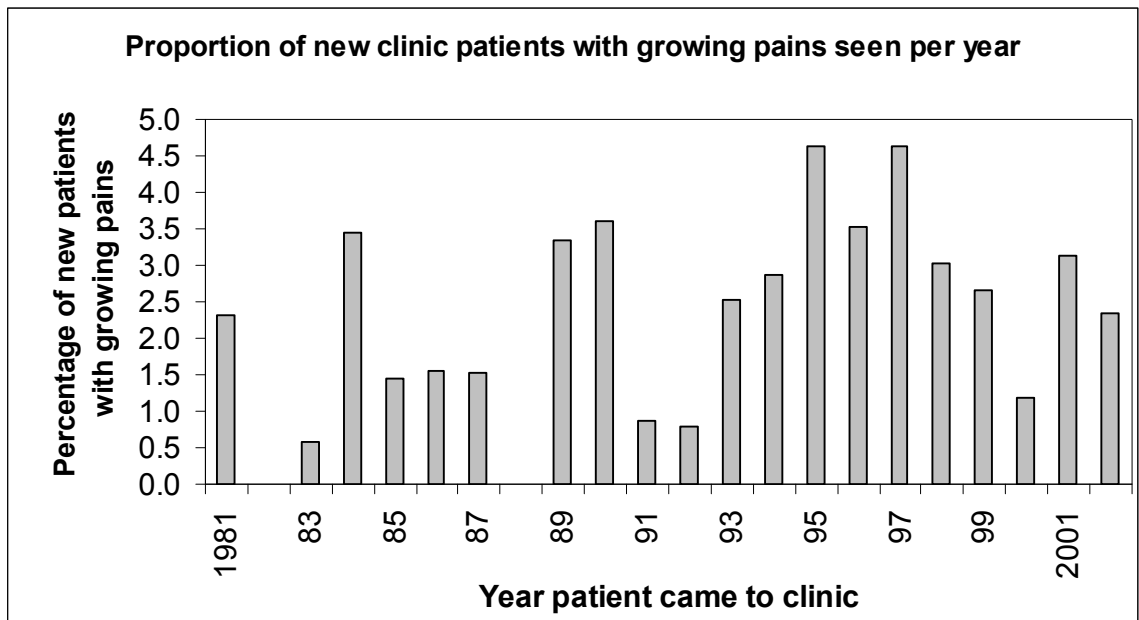
Table 4.1 Frequency of Age of Onset of Growing Pains

Onset Age (years)	Number (Percentage)
Missing Data	33 (47.8)
<1	1 (1.4)
1	2 (2.9)
2	10 (14.5)
3	4 (5.8)
4	7 (10.1)
5	1 (1.4)
6	2 (2.9)
7	3 (4.3)

Table 4.2 Frequency of Children by Ethnicity

Ethnicity	Number (Percentage)
Missing information	4 (5.8)
Caucasian	55 (79.7)
North American Indian	4 (5.8)
Metis	4 (5.8)
Other	2 (2.9)

Figure 4.1 Proportion of New Patients with Growing Pains seen per Year



Parents expressed a range of concerns about their children with regard to the pain experience. Most parents described being concerned about “the pain” or about helping their child deal with the pain. Also, parents were concerned about getting a

diagnosis for the condition or, in some cases, about whether the pain represented a condition more severe than growing pains. Parents were also concerned about their child's sleep – some parents related sleep difficulty to the pain. Five parents noted that their child's gait was affected by pain. For example, one parent said his or her child “walks like a duck and can't straighten up when has flare ups.” Another parent noted that his or her child “sometimes says can't walk and asked to be carried.” Concerns parents had about their children are summarized in Table 4.5. With regard to factors that might trigger the pain, one parent noted that the child's legs ached when it was cool and that the child slept with socks, pants, and leggings. Another parent mentioned the child had missed a lot of school in the winter because of pain. One parent mentioned that his or her child experienced pain after strenuous activity. Only two parents noted the frequency of the pain. Both of these parents said that their child experienced weekly and sometimes daily pain around the knees.

#### **4.3.3 Bivariate Analyses of the Growing Pains Group Compared to the Control Group**

Greater than 5% of the data were missing for 25 of the 69 cases of children with growing pains. Removing those cases yielded a sample of 44 children with growing pains. Because the data were categorical, nonparametric statistical tests were appropriate for analyzing this sample. Children with growing pains were significantly younger ( $M = 4.77$ ,  $SD = 1.83$ ) compared to children in the control sample ( $M = 10.66$ ,  $SD = 4.45$ ),  $t(146.35) = -21.95$ ,  $p = <0.001$  (2-tailed). Therefore, a matched control sample was created by computing the age of the children at the index visit to the clinic. Each of the 44 children with growing pains was matched to a child from the control group of the

same age. There were more males in the control group compared to the growing pains group - 24 males in the control group and 19 males in the growing pains group.

Table 4.3 Location of Child's Pain According to Parents

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<u>Location of Pain</u>	<u>Number of Parents who Mentioned the Location</u>
Legs	20
Knees	19
Ankles	3
Toes/Feet	2
Arms	5
Elbows	2
Wrists	2
Hands	1
Joints	5

---

Table 4.4 Sensory Descriptors used by Parents

Sensory Descriptor	Number of Parents
Ache	14
Sore	7
Hurt	2
Cramp	2
Numb	1
Restless	1

Table 4.5 Parents' Concerns about their Children

Concern	Number of Parents who Mentioned the Concern
Pain	13
Getting a diagnosis/a more severe condition	12
Sleep	7
Decreased activity level	2
Is there a treatment?	2
Giving Tylenol	2
Pain in a location other than limbs	2
Child unable to walk at times	1
Missing school	1
Lack of flexibility	1
Permanent damage	1



#### **4.3.3.1. Parental variables: Mothers' experiences during the pregnancy and parent marital status.**

The sign test showed that significantly more children with growing pains had a mother who experienced an illness or rash during the pregnancy compared to mothers of control children,  $p = .022$ . The odds ratio between having growing pains and having a mother who had an illness or rash during the pregnancy was 5.0 (95% CI: 1.30, 19.25). Children with growing pains in the sample were five times more likely to have had a mother who had a rash or illness during the pregnancy compared to children without pain. The sign test showed no significant difference between children with growing pains and control children on whether the mother drank alcohol during the pregnancy,  $p = 1.00$ , smoked during the pregnancy,  $p = .81$ , or had any medical or surgical problems during the pregnancy,  $p = .219$ . There were also no significant differences related to the parents' marital status,  $p = .227$  for mothers and  $p = .065$  for fathers. Table 4.6 summarizes the results for parental variables.

Table 4.6 Mothers' Experiences during the Pregnancy and Parent Marital Status

Variable	Growing Pains	Control	Sign-Test	Odds Ratio with 95% Confidence Interval
Mother had illness or rash during the pregnancy	27.3%	7.0%	$p = .022^*$	5.00 (1.299 - 19.246)*
Mother used alcohol during the pregnancy	12.2%	11.6%	$p = 1.00$	1.06 (2.82 - 3.954)
Mother smoked during the pregnancy	28.6%	22.7%	$p = .815$	1.36 (.514 - 3.596)
Mother had medical or surgical problems during the pregnancy	12.5%	2.3%	$p = .219$	6.00 (.669 -53.793)
Mother's marital status (married)	77.3%	93.2%	$p = .227$	.249 (.063 - .977)
Father's marital status (married)	72.7%	93.2%	$p = .065$	.195 (.051 - .750)

\*Significant result

#### 4.3.3.2 Developmental milestones and temperament.

The sign test showed no significant difference between children with growing pains and control children on the following developmental milestones: smiling by 8 weeks,  $p = 1$ ; sitting by 8 months,  $p = 1$ ; standing by 10 months,  $p = .63$ ; using 3 words by 20 months,  $p = .34$ ; cut first tooth by 8 months,  $p = .15$ ; walking by 14 months,  $p = .58$ ;

speaking in 3 word sentences by 2 years,  $p = .30$ . None of the odds ratios were positive for these variables. Table 4.7 summaries the results for the sign-tests and odds ratios.

The Wilcoxon matched pairs signed rank test showed no difference between children with growing pains and control children on toilet training (age toilet trained for bladder and bowel, day and night),  $p > .2$  for all four variables.

The Wilcoxon matched pairs test showed no significant difference between children with growing pains and control children on temperament - both during the daytime,  $p = .56$  and at night time,  $p = .20$ . Temperament was defined as how easy the child was to care for during the daytime and during the night time.

The Wilcoxon matched pairs test showed no significant difference between children with growing pains and control children on weight at birth,  $p = .423$ .

#### **4.3.3.3. School functioning**

The sign test showed no significant difference between children with growing pains and control children on the following variables that assessed functioning at school: missing school,  $p = .109$ , cooperation with teachers,  $p = 1.00$ , getting along with other students,  $p = 1.00$ , doing homework independently,  $p = .500$ , participating in extracurricular activities,  $p = .500$ , having hobbies,  $p = .581$ , problems getting along with others including family members,  $p = .289$ . Odds ratios showed no significant associations between growing pains and school functioning. Table 4.8 summarizes the results for school functioning.

Table 4.7 Age at which Developmental Milestones were Met

Variable	Growing Pains	Control	Sign-Test	Odds Ratio (95% CI)
Smiled by 8 weeks	95.0%	95.5%	$p = 1.00$	.905 (.121 - 6.742)
Sat without support by 8 months	88.4%	90.9%	$p = 1.00$	.760 (.190 - 3.044)
Stood by 10 months	71.4%	79.5%	$p = .63$	.643 (.238 - 1.734)
Spoke 3 words by 8 months	93.0%	84.1%	$p = .34$	2.523 (.607 - 10.483)
Cut first tooth by 8 months	77.5%	90.9%	$p = .15$	.344 (.097 - 1.224)
Walked by 14 months	79.1%	86.4%	$p = .58$	.596 (.192 - 1.850)
Spoke in 3 word sentences by 2 years	85.4%	70.5%	$p = .30$	2.446 (.830-7.213)

Table 4.8 School Functioning

Variable	Growing Pains	Control	<sup>a</sup> Sign Test	<sup>b</sup> Odds Ratio (95% CI)
Missing school	39.1%	12.0%	$p = .109$	4.714 (1.086 - 20.427)*
Likes school	95.2%	100%	---	.5 (.367 - .682)
Cooperation with teachers	100%	100%	$p = 1.00$	---
Getting along with other students	100%	100%	$p = 1.00$	---
Doing homework independently	69.2%	85.7%	$p = .50$	.375 (.056 - 2.519)
Participation in extracurricular activities	94.1%	94.1%	$p = .50$	1 (.057 - 17.411)
Has hobbies	70.7%	66.7%	$p = .581$	1.208 (.477 - 3.061)
Problems getting along with others (family &/or friends)	77.8%	22.2%	$p = .289$	3.986 (.778 - 20.26)

<sup>a</sup>Sign tests could not be computed for all variables

<sup>b</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way.

\*Significant result

#### 4.3.3.4 Illnesses

The sign test showed no significant difference between children with growing pains and children without growing pains on whether they had experienced the following illnesses: red measles,  $p = 1.00$ , baby measles,  $p = .774$ , urinary problems,  $p = 1.00$  serious infections,  $p = 1.00$ , unconsciousness,  $p = .500$ , back pain,  $p = .250$ , weight loss,  $p = 1.00$ , hair loss,  $p = 1.00$ , sensitivity to sunlight,  $p = .125$ , chicken pox,  $p = .454$ , whooping cough,  $p = 1.00$ , ear problems,  $p = .541$ , sinus infections,  $p = .625$ , cold hands,  $p = 1.00$ , fevers,  $p = .238$ , change in voice,  $p = 1.00$ , bleeding,  $p = .50$  lumps under skin,  $p = .50$ , eye problems,  $p = .453$ , pneumonia,  $p = .727$ , tonsillitis,  $p = .508$ , kidney problems,  $p = 1.00$ , diarrhea,  $p = .581$ , dizziness,  $p = 1.00$ , seizures, convulsions or fits,  $p = 1.00$ , mouth ulcers,  $p = .625$ , shortness of breath,  $p = .727$ , and bed wetting,  $p = .344$ . Significantly more children with growing pains had a skin rash,  $p = .065$ , but this result was only significant at the  $p < .10$  level; the odds ratio, however, was significant with a 95% Confidence Interval (OR: 3.774, CI 1.108, 12.860).

Significantly more children with growing pains were reported by parents to have experienced the following problems compared to the control children: fatigue,  $p = .016$ , joint pain,  $p < .001$ , joint swelling,  $p = .016$ , abdominal problems,  $p = .031$ , muscle pain or weakness,  $p < .001$ .

The sign test showed that significantly more children with growing pains had a family member with the following illnesses compared to control children: pain problems,  $p = .012$ , muscle disease,  $p = .031$ , and arthritis,  $p = .035$ .

Table 4.9 summarizes the results for child illness and table 4.10 summarizes the results for illness in the family.

Table 4.9 Illnesses Experienced by Children

Variable	Growing Pains	Control	Sign-Test	<sup>a</sup> Odds Ratio (95% CI)
Red measles	7.0%	4.7%	$p = 1.00$	1.538 (.244 - 9.695)
Baby measles	15.9%	11.6%	$p = .774$	1.438 (.419 - 4.937)
Urinary Problems	7.0%	4.7%	$p = 1.00$	1.538 (.244 - 9.695)
Serious Infections	4.7%	2.3%	$p = 1.00$	2.049 (.179 - 23.476)
Unconsciousness	4.5%	0%	$p = .500$	---
Back pain	7.0%	0%	$p = .250$	---
Weight loss	0%	0%	$p = 1.00$	---
Hair loss	2.3%	2.3%	$p = 1.00$	1.00 (0.61 - 16.521)
Sensitivity to sunlight	9.3%	0%	$p = .125$	---
Chicken pox	39.5%	50.0%	$p = .454$	.654 (.279 - 1.530)
Whooping cough	0%	0%	$p = 1.00$	---
Ear problems	52.3%	41.9%	$p = .541$	1.521 (.652 - 3.548)

<sup>a</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x 2 table.

\*Significant result

Table 4.9 (continued) Illnesses Experienced by Children

Variable	Growing Pains	Control	Sign-Test	<sup>a</sup> Odds Ratio (95% CI)
Sinus infections	7.0%	2.3%	$p = .625$	3.150 (.314 - 31.332)
Cold Hands	4.7%	2.3%	$p = 1.00$	2.049 (.179 - 23.478)
Fevers	38.6%	23.3%	$p = .238$	2.078 (.818 - 5.277)
Change in voice	0%	0%	$p = 1.00$	---
Bleeding	0%	4.7%	$p = .50$	---
Lumps under skin	4.7%	7.0%	$p = .50$	.650 (.103 - 4.101)
Eye problems	11.6%	4.7%	$p = .453$	2.697 (.494 - 14.738)
Pneumonia	11.6%	7.0%	$p = .727$	1.754 (.392 - 7.852)
Tonsillitis	18.6%	9.3%	$p = .508$	2.229 (.617 - 8.048)
Kidney problems	0%	0%	$p = 1.00$	---
Diarrhea	20.9%	14.0%	$p = .581$	1.632 (.526 - 5.069)
Dizziness	2.3%	0%	$p = 1.00$	---

<sup>a</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x 2 table.

\* Significant result



Table 4.9 (continued) Illnesses Experienced by Children

Variable	Growing Pains	Control	Sign-Test	<sup>a</sup> Odds Ratio (95% CI)
Seizures, convulsions or fits	4.7%	2.3%	$p = 1.00$	2.049 (.179 - 23.476)
Mouth ulcers	7.0%	2.3%	$p = .625$	3.150 (.314 - 31.552)
Shortness of breath	11.6%	7.0%	$p = .727$	1.754 (.392 - 7.852)
Bed wetting	11.6%	20.9%	$p = .344$	.497 (.152 - 1.629)
Fatigue	16.3%	0%	$p = .016^*$	---
Joint pain	77.3%	0%	$p < .001^*$	---
Joint swelling	18.2%	0%	$p = .016^*$	---
Abdominal problems	14.0%	0%	$p = .031^*$	---
Muscle pain or weakness	34.1%	0%	$p < .001^*$	---
Skin rashes	27.9%	9.3%	$p = .065$	3.774 (1.108 - 12.860)*

<sup>a</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x 2 table.

\*Significant result

Table 4.10 Illnesses in the Family

Variable	Growing Pains	Control	Sign Test	<sup>a</sup> Odds Ratio (95% CI)
Pain Problems	25.6%	2.3%	$p = .012^*$	14.438 (1.771 - 117.680)*
Muscle Disease	14.0%	0%	$p = .031^*$	---
Arthritis	52.3%	25.6%	$p = .035^*$	1.707 (1.138 - 2.561)*

<sup>a</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x2 table

\* Significant result

#### 4.3.3.5. Living environment

The Wilcoxon matched pairs signed rank test showed no difference between children with growing pains and control children on the number of children that lived in the home,  $p = .475$ .

Chi square tests showed no significant difference between children with growing pains and control children on the type of home they lived in (new – less than five years, older home, mobile home, apartment, other)  $p = .987$ . There was no difference in the type of heating in the home. Both in the control group and the growing pains group, the most common type of heating was a furnace. Statistics were not calculated because there were fewer than five participants in each group for the other types of heating: woodstove, hot water radiator and hot air ducts. There was no difference in the type of insulation in the home: most children came from homes where

the insulation was fiberglass. Statistics were not calculated because only four children in the sample had styrofoam insulation.

#### **4.3.4 Comparison of Children with Growing Pains to Children with Oligoarticular Juvenile Idiopathic Arthritis (JIA)**

Each of the 44 children with growing pains was matched based on age to a child who was diagnosed with juvenile idiopathic arthritis of the oligoarticular type (pain in four or fewer joints). There were 19 males in the growing pains group and 18 males in the juvenile idiopathic arthritis group (JIA).

##### **4.3.4.1 Parental variables: Mothers' experiences during the pregnancy**

The sign test showed significantly more children with growing pains had a mother with an illness or rash during the pregnancy compared to mothers of children with JIA,  $p = .039$ .

The sign test showed no significant difference between children with growing pains and children with JIA on whether the mother drank alcohol during the pregnancy,  $p = 1.00$ , smoked during the pregnancy,  $p = .700$ , or had any medical or surgical problems during the pregnancy,  $p = .344$ . Table 4.11 is a summary of the tests of parental variables.

Table 4.11 Comparison of Mothers' Experiences during the Pregnancy between Mothers of Children with Growing pains and Mothers of Children with Juvenile Idiopathic Arthritis

Variable	Growing Pains	JIA	Sign-Test	Odds Ratio	95% Confidence Interval
Mother had illness or rash during the pregnancy	27.3%	9.1%	$p = .039^*$	3.750*	(1.103 - 12.744)*
Mother used alcohol during the pregnancy	15.9%	12.2%	$P = 1.00$	.734	(.213 - 2.527)
Mother smoked during the pregnancy	36.4%	28.6%	$P = .700$	.700	(.282 - 1.736)
Mother had medical or surgical problems during the pregnancy	7.0%	12.5%	$p = .344$	1.905	(.424 - 8.550)

\*Significant test

#### 4.3.4.2 Developmental milestones and temperament

The sign test showed no difference between children with growing pains and children with JIA on the following developmental milestones: smiling,  $p = .688$ ; sitting,  $p = 1.00$ ; standing,  $p = .454$ ; talking (3 words),  $p = .727$ ; cut first tooth,  $p = .754$ ; walking,  $p = .267$ ; and talking (3 word sentences),  $p = 1.00$ . The odds ratio tests showed no association between the type of pain condition and developmental factors. Table 4.12 is a

summary of the tests of association between the type of pain condition and whether the child met developmental milestones.

The Wilcoxon matched pairs signed rank test showed no difference between children with growing pains and children with JIA on toilet training (age toilet trained for bladder and bowel, day and night training),  $p > .5$  for all four variables.

The Wilcoxon matched pairs test showed no difference between children with growing pains and children with JIA on temperament - both during the daytime,  $p = .657$  and at night time,  $p = .210$ .

The Wilcoxon matched pairs test showed no difference between children with growing pains and children with JIA on weight at birth,  $p = .106$ .

Table 4.12 Comparison of Children with Growing Pains and Children with Juvenile Idiopathic Arthritis on the Age at which Developmental Milestones were met

Variable	Growing Pains	JIA	Sign-Test	Odds Ratio	95% Confidence Interval
Smiled by 8 weeks	95.0%	92.7%	$p = .688$	1.5	(.237 - 9.491)
Sat without support by 8 months	88.4%	92.9%	$p = 1.00$	.585	(.131 - 2.619)
Stood by 10 months	71.4%	82.9%	$p = .454$	.515	(.179 - 1.476)
Spoke 3 words by 8 months	93.0%	88.4%	$p = .727$	1.754	(.392 - 7.832)
Cut first tooth by 8 months	77.5%	72.7%	$p = .754$	1.292	(.477 - 3.495)
Walked by 14 months	79.1%	90.9%	$p = .267$	.378	(.107 - 1.336)
Spoke in 3 word sentences by 2 years	85.4%	83.7%	$p = 1.00$	1.134	(.347 - 3.712)

#### **4.3.4.3 School functioning.**

The sign test showed no significant difference between children with growing pains and children with JIA on the following variables that assessed functioning at school: missing school,  $p = .727$ , participating in extracurricular activities,  $p = 1.00$ , having hobbies,  $p = 1.00$ , and problems getting along with others including family members,  $p = .109$ . Tests could not be conducted on whether the child liked school, cooperated with teachers, or got along with other students, because data were not available for many participants. There were likely missing data for school variables because the sample included children under five years, who would not have been attending school. Odds ratios showed no significant associations between the type of pain condition and school functioning. Table 4.13 summarizes the results for school functioning.

Table 4.13 Comparison of School Functioning between Children with Growing Pains and Children with Juvenile Idiopathic Arthritis

Variable	Growing Pains	JIA	<sup>a</sup> Sign-Test	<sup>b</sup> Odds Ratio	95% CI
Missing school	39.1%	34.8%	$p=.727$	1.205	(.363 - 3.99)
Like school	95.2%	95%	---	1.053	(0.61 - 8.05)
Cooperation with teachers	100%	100%	---	---	---
Getting along with other students	100%	95%	---	---	---
Doing homework independently	69.2%	100%	---	---	---
Participation in extracurricular activities	94.1%	94.4%	$p = 1.00$	.941	(.054 - 16.35)
Has hobbies	70.7%	73.7%	$p = 1.00$	.863	(.322 - 2.316)
Problems getting along with others (family &/or friends)	16.3%	7.1%	$p = 1.09$	2.528	(.607 - 0.524)

<sup>a</sup>Sign tests could not be computed when almost all of the participants in a group responded in the same way.

<sup>b</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way or when there were empty cells.



#### 4.3.4.4 Illnesses

The sign test showed no significant difference between children with growing pains and children with arthritis on whether they had experienced the following illnesses: red measles,  $p = 1.00$ , baby measles,  $p = 1.00$ , urinary problems,  $p = 1.00$ , serious infections,  $p = 1.00$ , unconsciousness,  $p = 1.00$ , back pain,  $p = .50$ , weight loss,  $p = .25$ , hair loss,  $p = 1.00$ , sensitivity to sunlight,  $p = 1.00$ , chicken pox,  $p = .146$ , sinus infections,  $p = 1.00$ , cold hands,  $p = 1.00$ , fevers  $p = .093$ , change in voice,  $p = .500$ , bleeding,  $p = 1.00$ , lumps under the skin,  $p = 1.00$ , eye problems,  $p = .774$ , pneumonia,  $p = .454$ , kidney problems,  $p = 1.00$ , diarrhea,  $p = 1.00$ , seizures, convulsions or fits,  $p = 1.00$ , skin rashes,  $p = 1.00$ , mouth ulcers,  $p = 1.00$ , shortness of breath,  $p = .063$ , bed wetting,  $p = 1.00$ , fatigue,  $p = .180$ , joint pain,  $p = .754$ , and abdominal problems,  $p = .125$ . Significantly more children with growing pains had a family member with easy bruising or bleeding,  $p = .070$ , but this result was only significant at the  $p < .10$  level; the odds ratio was not significant.

Significantly more children with JIA had experienced joint swelling compared to the children with growing pains,  $p < .001$ . Significantly more children with growing pains had experienced the following problems compared to the children with JIA: ear problems,  $p = .001$ , muscle pain or weakness,  $p = .008$ . The sign test showed that significantly more children with growing pains reportedly had a family member with the following illnesses compared to children with JIA: pain problems,  $p = .039$ , birth defects,  $p = .031$ , and nervous breakdown,  $p = .031$ .

Table 4.14 summarizes the results for comparisons of illness between children with growing pains and children with JIA and Table 4.15 summarizes the results for comparisons of illnesses in the family.

Table 4.14 Comparison of Illnesses Experienced by Children with Growing Pains and Children with Juvenile Idiopathic Arthritis

Variable	Growing Pains	JIA	Sign-Test	<sup>a</sup> Odds Ratio (95% CI)
Red measles	7.1%	5.1%	$p = 1.00$	1.423 (.225 - 9.004)
Baby measles	16.5%	15.4%	$p = 1.00$	1.069 (.326 - 3.509)
Urinary Problems	4.8%	5.1%	$p = 1.00$	.925 (.124 - 6.906)
Serious Infections	4.8%	7.7%	$p = 1.00$	.600 (.095 - 3.797)
Unconsciousness	4.7%	2.6%	$p = 1.00$	1.854 (.161 - 21.282)
Back pain	7.1%	2.6%	$p = .50$	2.923 (.291 - 29.356)
Weight loss	0%	5.1%	$p = .25$	---
Hair loss	2.4%	2.6%	$p = 1.00$	.927 (.056 - 15.344)
Sensitivity to sunlight	9.5%	7.7%	$p = 1.00$	1.263 (.264 - 6.040)
Chicken pox	40.5%	46.2%	$p = .146$	.793 (.329 - 1.914)

<sup>a</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x 2 table.

\*Significant result

Table 4.14 Comparison of Illnesses Experienced by Children with Growing Pains and Children with Juvenile Idiopathic Arthritis

Variable	Growing Pains	JIA	Sign-Test	<sup>a</sup> Odds Ratio (95% CI)
Sinus infections	7.1%	5.1%	$p = 1.00$	1.423 (.225 - 9.004)
Cold Hands	4.8%	2.6%	$p = 1.00$	1.9 (.165 - 21.824)
Fevers	39.5%	23.1%	$p = .093$	2.179 (.831 - 5.713)
Change in voice	0%	2.6%	$p = .50$	---
Bleeding	0%	0%	$p = 1.00$	---
Lumps under skin	4.8%	2.6%	$p = 1.00$	1.900 (.165 - 21.824)
Eye problems	11.9%	15.4%	$P = .774$	.743 (.207 - 2.663)
Pneumonia	11.9%	2.6%	$p = .454$	5.135 (.572 - 46.078)
Kidney problems	0%	0%	$p = 1.00$	---
Diarrhea	19.0%	20.5%	$p = 1.00$	.912 (.305 - 2.723)
Seizures, convulsions or fits	4.8%	2.6%	$p = 1.00$	1.900 (.165 - 21.824)
Skin Rashes	26.2%	23.1%	$p = 1.00$	1.183 (.429 - 3.260)

<sup>a</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x 2 table.

\*Significant result

Table 4.14 Comparison of Illnesses Experienced by Children with Growing Pains and Children with Juvenile Idiopathic Arthritis

Variable	Growing Pains	JIA	Sign-Test	<sup>a</sup> Odds Ratio (95% CI)
Mouth ulcers	7.1%	7.7%	$p = 1.00$	.923 (.175 - 4.870)
Shortness of breath	11.9%	0%	$p = .063$	---
Bed wetting	11.9%	12.8%	$p = 1.00$	.919 (.244 - 3.454)
Fatigue	16.7%	7.7%	$p = .180$	2.4 (.574 - 10.032)
Joint pain	76.7%	76.9%	$p = .754$	.990 (.354 - 2.766)
Abdominal pain	14.3%	2.6%	$p = .125$	6.333 (.726 - 55.221)
Ear problems	53.5%	17.9%	$p = .001^*$	5.257 (1.907 - 14.490)*
Joint swelling	18.6%	79.5%	$p < .001^*$	.59 (.020 - .176)*
Muscle pain or weakness	32.6%	7.7%	$p = .008^*$	5.793 (1.518 - 22.111)*

<sup>a</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x 2 table.

\*Significant result

Table 4.15 Comparison of Illnesses in the Family between Children with Growing Pains and Children with Juvenile Idiopathic Arthritis

Variable	Growing Pains	JIA	Sign Test	<sup>a</sup> Odds Ratio (95% CI)
Pain Problems	25%	9.1%	$p = .039^*$	3.333(.971 - 11.446)
Birth Defects	13.6%	0%	$p = .031^*$	---
Nervous Breakdown	13.6%	0%	$p = .031^*$	---
Easy Bruising or Bleeding	18.2%	4.5%	$p = .070$	4.667 (.931 - 23.397)

<sup>a</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x 2 table.

\*Significant result

#### 4.3.4.5 Living environment

The Wilcoxon matched pairs signed rank test showed that children with JIA had more children living in the home compared to children with growing pains,  $p = .029$ .

#### 4.3.5 Logistic Regression

Regression modeling was conducted on the sample of 69 children with growing pains and 69 matched control children, using only the variables that were significant at  $p < 0.25$  in univariable analyses or were of clinical interest and had no numerical problems such as multicollinearity. Variables deemed to be clinically relevant were those that have been documented in the literature to have a relationship to chronic pain. Gender was deemed to be of clinical relevance as females report more chronic and recurrent pain compared to males (Eccleston & Malleon, 2003). It was expected, however, that gender would not be a significant or confounding variable as gender matched controls had been

selected. Family pain conditions were also deemed to be of clinical significance because of literature indicating aggregation of pain in families (Grøholt, Stigum, Nordhagen, & Köhler, 2003; Laurell, Larsson, & Eeg-Oloffson, 2005). It was necessary to restrict the number of variables in the model to ensure numerical stability and, therefore, only those pain conditions that had significant univariable analyses were included (back problems in the family, arthritis in the family). Table 4.16 summarizes the univariable analyses of the twelve variables used in the regression modeling: mother having an illness or rash during the pregnancy, mother smoking during the pregnancy, child's weight at birth, child's birth season, child first standing at greater than 10 months, child first speaking in three word sentences past two years of age; fatigue in the child; skin rashes in the child; arthritis in the family, back problems in the family, stomach or intestinal problems in the family, child's gender. Two models were found to adequately fit the data using forward stepwise modeling with likelihood ratio tests and the backward stepwise elimination with likelihood ratio tests. Model one (see Table 4.17) was significant at the  $p < 0.001$  level and showed that the following predictor variables were significantly associated with growing pains: maternal illness or rash during the pregnancy, maternal smoking during the pregnancy, child standing at greater than 10 months, and back pain in the family. Model two was statistically significant at the  $p < .001$  level and included the same associations with the addition of arthritis in the family (see Table 4.18). The potential confounder status of the covariate gender was tested by comparing the estimated coefficients for the predictor variables with models containing and not containing gender. There was no difference in the estimated coefficients and it was concluded that gender was not a confounder. Therefore, this variable was not included in the model.

After fitting the models to the data they were assessed for significance of the coefficients of the variables in the model. All variables had significant Wald tests at the 0.05 level, with arthritis in the family approaching significance at 0.057. None of the variables showed standard errors larger than 7, indicating no numerical problems among the independent variables. Both models show that children with growing pains compared to control children were approximately 20% more likely to have a mother who had an illness or rash during the pregnancy, 20% more likely to have a mother who smoked during the pregnancy, 3 to 4 times more likely to have first stood after 10 months, and 30% more likely to have a family member with back pain. Additionally, model 2 shows that children with growing pains were 40% more likely to have a family member with arthritis.

Table 4.16 Univariable Analysis of Predictor Variables for Growing Pains

Variable	Variable Type	<sup>a</sup> Chi-Square <i>p</i> -value	<sup>b</sup> Odds Ratio (95% Confidence Interval)
Mother had an illness or rash during the pregnancy	Dichotomous	0.004	*4.8 (1.56 - 14.804)
Mother smoked during the pregnancy	Dichotomous	0.026	*3 (1.109 - 8.124)
Child's weight at birth	Nominal	0.078	Not calculated
Season in which the child was born	Nominal	0.112	Not calculated
Child stood after 10 months	Dichotomous	0.012	*.282 (.101 - .790)
Child spoke in 3 word sentences by 2 years	Dichotomous	0.199	1.944 (.697 - 5.421)
Child has experienced fatigue	Dichotomous	0.001	---
Child has had skin rashes	Dichotomous	0.127	2.041 (.808 - 5.158)
Family member with arthritis	Dichotomous	0.093	1.928 (.894 - 4.158)
Family member with back pain	Dichotomous	0.029	*2.492 (1.087 - 5.714)
Family member with stomach or intestinal problems	Dichotomous	0.187	1.806 (.745 - 4.378)
Gender	Nominal	1	1.00 (.510 - 1.960)

<sup>a</sup>Significant at  $P < .25$ <sup>b</sup>Odds ratios are not applicable to variables where all of participants in both groups responded in the same way nor when there are empty cells in a 2 x 2 table\*Significant odds ratio result at  $p < .25$



Table 4.17 Model 1: Variables Predicting Growing Pains

Variables	Standard Error	Wald	Significance	Exp (B)
Maternal Illness or Rash During Pregnancy	.631	5.272	0. 022	.235
Maternal Smoking During Pregnancy	.568	6.808	0.009	.227
Child Stood After 10 months	.577	5.014	.025	3.639
Family Member with Back Pain	.491	5.191	.023	.327

Table 4.18 Model 2: Variables Predicting Growing Pains

Variables	Standard Error	Wald	Significance	Exp (B)
Maternal Illness or Rash During Pregnancy	.660	5.755	0. 016	.260
Maternal Smoking During Pregnancy	.580	6.488	0.011	.228
Child Stood After 10 Months	.601	5.610	.018	4.147
Family Member with Back Pain	.500	4.673	.031	.339
Family Member with Arthritis	.467	3.610	.057	.411

Both models were fairly equal in fitting the data; both had similar -2 log likelihood levels (119.618 for model 1 and 116.087 for model 2). The percentage of the dependent variable (growing pains) accounted for by the predictors was similar for both models (Nagelkerke R- square was .257 in model 1 and .295 in model 2). The Hosmer and Lemeshow statistic also evaluates the goodness-of-fit of the model by testing the null hypothesis that there is no difference between the observed and model-predicted values of growing pains. For model 1 the test was not significant ( $p = .677$ ) and for model 2 the test was also not significant ( $p = .532$ ), indicating that both models fit the data. Models 1 and 2 had classification accuracy rates of 70.4%. Model 1 showed slightly lower sensitivity (35%) compared to model 2 (47.5%), but showed slightly higher specificity (91%) compared to model 2 (91%). Sensitivity was defined as the proportion of children in the growing pains group correctly identified as having growing pains and specificity was defined as the proportion of children in the control group correctly identified as not having growing pains. The likelihood ratio of a positive test was 3.98 for model 1 and 3.23 for model 2. The likelihood ratio of a negative test was 0.71 for model 1 and 0.615 for model 2.

#### **4.4 Discussion**

In this clinic sample the age range for onset was 1 to 7 years ( $M = 3.3$ ), compared to 1 to 13 years ( $M = 5.7$ ) in a larger sample from rheumatology centers in the United States (Denardo et al., 1994). However, data on the age at onset were not available for half of the current sample. In this sample significantly more mothers of children with growing pains had experienced a rash or illness during pregnancy compared both to mothers of the control children and to mothers of children with JIA. Significantly more children with growing pains had the following symptoms compared to control

children: fatigue, joint pain, joint swelling, abdominal problems, and muscle pain or weakness. Significantly more children with growing pains had experienced ear problems and muscular pain or weakness compared to children with JIA. Significantly more children with JIA had experienced joint swelling compared to children with growing pains. Significantly more children with growing pains had a family member with pain problems, muscle disease or arthritis compared to control children. Significantly more children with growing pains had a family member with symptoms of pain, birth defects, or nervous breakdown, compared to children with JIA. Children with JIA had more children living in the home compared to children with growing pains. Illness or rash during pregnancy, smoking during pregnancy, age at standing greater than 10 months, back pain among relatives, and arthritis among relatives, were predictors of growing pains in logistic regression analysis.

It was expected that children with growing pains would be more likely to experience “muscle pain or weakness,” compared to control children, as muscle pain is a feature of growing pains. Typically, joint pain and joint swelling are considered exclusionary factors for growing pains. Therefore, it is surprising that children with growing pains in this sample were more likely to experience these symptoms compared to control children. However, the report was based on parents’ perceptions and memories and, therefore, it is possible that parents assumed the pain was in the joints when the pain might have been around the joints. In fact, joint swelling proved to be a factor that distinguished children with growing pains from children with arthritis, as expected. The finding that children with growing pains were more likely to experience muscle pain or weakness compared to children with arthritis could be explained by parents

distinguishing pain in arthritis as being related to joints rather than muscles. It was not surprising that children with growing pains were more likely to experience fatigue compared to control children, as growing pains is a nocturnal condition that can interfere with sleep (Lowe & Hashkes, 2008; Oberklaid et al., 1997; Seham & Hilbert, 1933). It was also expected that children with growing pains would be more likely to experience abdominal pains. This result is in line with previous findings of associations between recurrent abdominal pain and limb pains (Perquin, et al., 2000; Ramchandani, Hotopf, Sandhu, Stein, & the ALSPEAC Study Team, 2005; van Dijk et al., 2006).

The finding that children with growing pains were more likely to have a family member with pain problems, as compared to control children and children with JIA, is consistent with studies that have found a familial aggregation of pain symptoms (Grøholt, Stigum, Nordhagen, & Köhler, 2003; Laurell, Larsson, & Eeg-Oloffson, 2005).

Although previous studies have documented that growing pains tends to run in families (Apley, 1976; Evans & Scutter, 2004a), there have been no studies documenting whether children with growing pains are more likely to have family members with other pain problems and the kinds of pain problems that tend to run in families of children with growing pains. It is not known why children with growing pains were more likely to have family members with pain problems compared to children with JIA. However, in the current data this result was not strongly supported statistically. Pain in the family could influence growing pains through genetic inheritance and could also impact display of pain behavior through social learning or modeling (Chambers, Craig, & Bennett, 2002; Evans, Keenan, & Shipton, 2007; Piira & Pullukat, 2006; Schanberg et al., 2001).

The association between growing pains and having a mother who had an illness or rash during the pregnancy was the most robust finding statistically. Unfortunately the type of illness or rash was not documented. There have been no other studies to this author's knowledge examining a relationship between illnesses in pregnancy and musculoskeletal pain in children. However, there is evidence indicating a relationship between noxious stimuli in infancy and long term changes in nociceptive processing (Hermann, Hohmeister, Demirakça, Zohsel, & Flor, 2006; LaPrairie & Murphy, 2006; Lidow, 2002; Ponder, 2002). It is plausible then that other types of exposures during the critical development period may also contribute to changes in the neonatal nervous system (Mallen, Peat, Tomas, & Croft, 2006). It is possible that prenatal factors such as illness during the pregnancy and smoking could influence development of growing pains through intrauterine inflammation which could result in pain hyper-responsiveness in later life (A. M. Rosenberg, personal communication, November 21, 2006). Consistent with this hypothesis, Jaakkola and Gissler (2005) documented a relationship between maternal smoking during pregnancy and increased risk of rheumatoid arthritis and other inflammatory polyarthropathies in childhood, though only for females. They suggested that fetal exposure to tobacco smoke could influence the developing immune system.

The developmental milestone of standing at greater than 10 months could influence growing pains through the impact of decreased bone density. Decreased bone strength has been found to be associated with growing pains (Friedland et al., 2005). Nonambulatory children who engage in standing exercises have shown improvements in bone density (Caulton et al., 2004; Stuberg, 1992). However, there have been no studies examining whether delayed standing impacts bone density.

The following findings do not have theoretical support: children with growing pains were more likely to experience ear problems compared to children with JIA, children with growing pains were more likely to have family members who had experienced a nervous breakdown or had a birth defect compared to children with JIA, children with JIA had more children living in the home compared to children with growing pains. Although it is possible that having a family member who had a nervous breakdown could lead to increased stress and, thus, lend support to a psychosocial theory for growing pains, the data were subjective (i.e. parent report) and it is unknown which family member had a nervous breakdown and whether this family member lived with the child. In some cases, parent report could have been influenced by recall-bias and negative reporting bias. The finding that children with JIA have more children living in the home indicates that there could be greater humidity in these homes compared to the homes of children with growing pains, which would be in contradiction to previous observations of a damp room precipitating occurrence of growing pains (Apley, 1976). However, humidity is related to the number of individuals in the home and their living habits, and we do not know whether overall there were more individuals in the homes of children with JIA compared to the children with growing pains.

Limitations of the study need to be taken into account in interpreting the findings. The sample represents children who were referred to a rheumatology clinic; there are probably differences between this sample and a community sample, in particular in parent help-seeking. The study was exploratory and statistical analyses, therefore, were numerous and not guided by hypotheses. The data were based on questionnaire responses, some of which were based on retrospective information, and it is possible that

parents were not always accurate when completing the questionnaire. Some of the data collected were limited by the nature of the question asked. For example, the type of illnesses experienced by mothers during pregnancy is unknown and the actual age at which children met the developmental milestone of standing is unknown. There may be other unmeasured variables that explain some of the logistic regression results. One possibility is Vitamin D deficiency in pregnancy which might affect muscle development (Pasco et al., 2008). There could be a relationship between maternal vitamin D deficiency and age at standing. It is also possible that the relationship between growing pains and family back pain could be explained by family dynamics – parents who take their children to the physician for growing pains might be more likely to complain about pain problems. The strength of the current study is that it provides direction for factors to be examined in future studies: primarily, illnesses during pregnancy, smoking during pregnancy, age at which the child pulls to standing, and types of pain problems in other family members.

## CHAPTER 5 CHILDREN'S EXPERIENCES WITH GROWING PAINS

### 5.1 Introduction

Although growing pains is a common condition, little is known about children's experiences with the pain, that is, how they make sense of the pain and how the pain experience impacts them, either in a positive or in a negative manner. It is assumed that growing pains is benign or harmless as there is no evidence suggestive of long-term physiological impact or future rheumatic disease. However, from a psychological perspective, the experience of recurrent pain is not necessarily benign and in some cases could be associated with poor coping. Our knowledge of children's experiences with growing pains is based on anecdotal reports and from information collected in prevalence studies. There have been some commentaries and prevalence studies suggesting that growing pains is exacerbated by exercise (Naish & Apley, 1951), is relieved by massage and medication (Manners, 1999), and can inhibit activity (Abu-Arafeh & Russell, 1996; Oster & Nielsen, 1972), yet no study has directly focused on understanding children's experiences with growing pains. It is becoming increasingly common to elicit children's representations of health concerns in order to learn about their health experiences (Docherty & Sandelowski, 1999). However, prior to the current study, only one study to this author's knowledge had asked children about their experiences with growing pains and no study has attempted to integrate the information on growing pains into a conceptual model. Evans and Scutter (2004b) utilized the focus



group method to find out about children's experiences with growing pains in order to develop a parental questionnaire for growing pains in children aged 4 to 6 years.

However, their focus group consisted of only two children. There are numerous accounts of growing pains in the lay literature and it is problematic that we know so little about children's experiences with growing pains as the advice given to parents is often based on personal experience and not grounded in theory or research. For example, a commentary on growing pains in a book geared to parents of toddlers reads:

Don't tell your toddler that her legs hurt because she's playing too hard or she may just become fearful of playing and refuse to do anything physical. It is a good idea, however, to try to slow her down just a bit without making it obvious to her. Nor should you tell her these are "growing pains"; such an explanation of her pain could instill a fear of growing and even inspire an eating strike (Eisenberg, Murkoff, & Hathaway, 1994, p.439).

The original purposes of the current study were (1) to develop an understanding of growing pains from children's perspectives; (2) to develop a conceptual model (along with information from the previous two studies) that describes factors that exacerbate and relieve the pain and that describes the impact of the pain on the child; and (3) to inform items for a child limb pain questionnaire. The chosen methodology for this study was grounded theory. In order to develop a conceptual model of growing pains focus groups and interviews were conducted with children, and parents completed questionnaires about their children's experiences with growing pains, and when relevant, their own experiences with growing pains. The interview data were analyzed through the processes of coding and memo-writing. The analysis resulted in development of a theoretical process model that conceptualizes children's experiences with growing pains. Data collected in this phase of the research were additionally integrated with data from phases I and II to develop a descriptive conceptual model of growing pains and to identify items

for a child limb pain questionnaire. This integration of the data is reviewed in Chapter 6. In this chapter, background information is provided on grounded theory, the focus group method and on interviewing children. The methods (focus group; individual interview; questionnaires; grounded theory coding and memo-writing) used in this phase of the research are reviewed and the theoretical process model of children's experiences with growing pains is presented.

## **5.2 Grounded Theory**

Grounded theory was the methodology that best suited the purpose of developing a conceptual model of children's experiences with growing pains using an inductive approach. Grounded theory methods were originally developed through the work of Glaser and Strauss (1965, 1967) and today there are many different approaches to grounded theory. A number of leading researchers in the field of grounded theory methods contend that there can be flexibility in data collection and analytical approaches within a grounded theory framework (Bryant, 2002; Charmaz, 2006; Clarke, 2005). The grounded theory methods used in the current research are based on the principles and practices explicated by Charmaz (2006). These methods are described in detail in the methods section of this chapter. Grounded theory methodology can be applied to both positivistic methods and to interpretative methods and can be applied to both qualitative and quantitative data (Charmaz, 1995). The current research takes an interpretative stance because the goal is to describe and understand children's personal experiences with growing pains and to elucidate how their experiences are constructed, for example, through their beliefs, actions, interactions, and feelings. Charmaz (2006) noted that interpretive theory "emphasizes understanding rather than explanation" (p. 126) and offered the following description of the goals of interpretive theory:

- Conceptualize the studied phenomenon to understand it in abstract terms
- Articulate theoretical claims pertaining to scope, depth, power and relevance
- Acknowledge subjectivity in theorizing and hence the role of negotiation, dialogue, understanding
- Offer an imaginative interpretation (p. 127).

I acknowledge that the theory being developed is the researcher's interpretation of children's experiences and that children's interpretation of their own experiences can be influenced by their social environment. When doing grounded theory it is important to let the research problem guide the choice of methods. In the case of the current research, to understand the phenomena of growing pains from children's perspectives, it was necessary to interview children in order to collect rich data. The next section describes methods of interviewing children.

### **5.3 The Focus Group Method**

#### **5.3.1 Purpose of Focus Groups**

Focus groups are used to elicit discussions that allow the researcher to tap into participants' experiences and perspectives (Heary & Hennessy, 2002; Kitzinger & Barbour, 1999). This is achieved through interaction among the participants, which is facilitated by the interviewer. Lewis (1992) noted that prompting by children, with reference to topics that the interviewer does not know to ask about, makes focus groups with children an effective method for researching children's perspectives. Through the focus group discussion the researcher can gain insight into participants' experiences, feelings, attitudes, behaviour and understanding around a particular topic (Horner, 2000;

McLafferty, 2004). Focus groups with children are an effective method for exploratory studies related to understanding children's experiences with health and illness (Heary & Hennessy, 2002; Horner, 2000). Exploratory focus groups with children have been used to generate hypotheses (Heary & Hennessy, 2002) and to develop conceptual models (Hockenberry-Eaton et al., 1999). In addition, focus groups have been used in questionnaire development (Charlesworth & Rodwell, 1997; McLafferty, 2004). In groups with children the researcher is able to identify the language children use to describe a phenomenon and can clarify children's understanding of concepts or terminology; this information is important to questionnaire development (Vaughn, Schumm, & Sinagub, 1996). The focus group method is also appropriate when the research question requires breadth of understanding, rather than the depth aimed for in individual interviews (Berg, 2001; Crabtree, Yanoshik, Miller, & O'Connor, 1993).

### **5.3.2 Contextual Influence on the Data**

Morgan and Krueger (1993) argued that focus groups encourage discussion of varied points of view, rather than producing conformity. In focus groups, as opposed to other kinds of group interviews, the goal is not to make decisions around a particular topic, but rather, participants are encouraged by the group facilitator to discuss a range of experiences, feelings and points of view (Morgan & Krueger, 1993). Concerns about conformity are related to concerns about bias in focus group data. However, all research is context-bound (Kitzinger & Barbour, 1999). The researcher needs to be aware of and make explicit how the context in which data are collected influences the data (Green & Hart, 1999). In the case of focus groups, the context will mean that group members might co-construct meaning. Their understanding of growing pains will already have been constructed based on what they have heard about growing pains from others

including siblings, parents, and physicians. However, group members might change their opinions or ways of thinking about the topic based on what they are hearing from other children in the group. This does not mean that the content of their experiences will change, but rather, how they interpret their experiences might be influenced by what they hear from others. This interaction among participants is an advantage in that the researcher is less likely to impose adult-centered interpretations onto children's experiences when children are generating ideas and discussing information together (Eder & Fingerson, 1996). Heary and Hennessy (2002) noted that because focus groups view children as experts, the results can have high face validity and be useful in developing conceptual models.

Another advantage to the focus group method with children is that the power relationship inherent in individual interviews with adults is diminished (Eder & Fingerson, 2002) and, therefore, children are less likely to respond in ways that they think the researcher wants them to (Heary & Hennessy, 2002; Horner, 2000; Shucksmith & Hendry, 1998). In a study with middle school children (11-14 years of age), Horner (2000) found that children were more forthcoming in focus groups than when interviewed individually by adults. Also, in focus groups, individual children are not pressured to answer questions that they do not fully understand as the onus lies with the group (Horner, 2000; Lewis, 1992). Morgan and Krueger (1993) noted that focus group participants may not initially be able to identify or express their feelings, but as they hear others talk they can identify whether what they are hearing fits their own situation. Morgan and Krueger also suggested that participants can become aware of what they had not thought of before as they answer questions from the moderator and other participants.

### **5.3.3 Group Size**

Typically, focus groups are small, consisting of a minimum of three individuals and a maximum of 12 individuals (Heary & Hennessy, 2002). Focus groups with children are typically smaller than those with adults. Hoppe, Wells, Morrison, Gillmore, and Wilsdon (1995) recommended having four or five participants in child groups, as this ensures that at least three children will be “talkers.” Children may have difficulty in a large group because of a greater tendency to interrupt and talk over others (Heary & Hennessy, 2002). Green and Hart (1999) found that five to six child participants was a practical number for producing audible tape without compromising flowing discussion.

### **5.3.4 Group Composition**

Most focus groups (with children) related to health research have been conducted with children older than five years. In a review of the literature on focus groups in pediatric health research, Heary and Hennessy (2002) found that only four studies out of 93 involved interviewing children under six years of age. Vaughn, Schumm, and Sinagub (1996) suggested that children over six are less likely to give socially desirable responses. They recommended that focus groups should not be conducted with children younger than five. However, Charlesworth and Rodwell (1997) found that children in kindergarten were able to effectively communicate with each other about their viewpoints during focus groups. Contrary to these findings, Klein and colleagues (1992) found that focus groups with children aged four to five years were unreliable. Smith, Duncan and Marshall (2005) conducted focus group studies with four-year-old children and found that the groups were difficult to manage. In fact, they had to end one session after only ten minutes. Vaughn, Schumm, and Sinagub (1996) suggested that including activities in the focus group can help children to maintain attention and

help children to express themselves. In conducting groups it is important to distinguish topic related activities from ice-breaker activities. Charlesworth and Rodwell (1997) conducted focus groups with children from kindergarten to fifth grade and found that ice-breaker exercises were unnecessary and, in fact, made it difficult for children to transition to the focus group task.

There is debate as to whether focus groups should consist of homogenous or heterogeneous members. With regard to gender, successful groups have been conducted with both mixed and single sex-groups (Balmer et al., 1997). Greenbaum (1998) recommended single-sex groups, arguing that young children prefer interacting with children of the same sex and that, in older groups, an interest in the opposite sex can hinder group productivity. In their research on adolescents' views of health issues, Shucksmith and Hendry (1998) found that single sex groups were more effective compared to mixed groups. Balmer and colleagues (1997) noted that whether single sex or mixed groups are used should depend on the research topic: mixed groups can be used effectively with general health behaviours and single-sex groups are effective when the topic involves pubertal changes.

Some researchers recommend friendship groups, while other researchers suggest that friendship groups may not provide diversity of information. Lewis (1992) argued that in friendship groups there is likely to be more free expression and Horner (2000) found that having group members who were familiar with each other helped in facilitating the group process. However, Vaughn, Schumm, and Sinagub (1996) argued that peer pressure is decreased when children do not know one another. Ultimately, whether friendship groups are appropriate depends on the research question.

### **5.3.5 Length of Focus Group Interviews**

Focus groups with children generally last a shorter amount of time compared to groups with adults. Vaughn and colleagues (1996) recommended 45 minutes of interviewing for children under 10 years and 60 minutes for children between 10 and 14 years. In a review of the literature, Heary & Hennessy (2002) found that focus groups with children typically lasted between 30 and 90 minutes.

### **5.3.6 The Moderator's Role**

The role of the focus group moderator is to facilitate group discussion by building rapport in the group, encouraging participation by all group members, summarizing comments, and using general and probing questions (Horner, 2000). The moderator can employ various strategies to encourage participation. Some examples include describing the role the children are expected to play during the interview (Docherty & Sandelowski, 1999), giving non verbal feedback such as nodding (Horner, 2000), using stimulus materials such as newspaper clippings and vignettes (Kitzinger & Barbour, 1999), directing follow-up probes to group members who have not had a chance to respond (Horner, 2000), and using non-directive neutral questions such as: “has anyone had a different experience?”(Horner, 2000).

Typically, the moderator uses a “moderator guide” which is a set of pre-prepared questions or an outline for the interview. Krueger (1993) stated that quality is compromised when too many questions are planned for. Also, when the researcher has a detailed interview guide, the structure imposed can hinder interaction amongst the group participants (Crabtree, Yanoshik, Miller, & O'Connor, 1993). Berg (2001) noted that experienced moderators tend to deviate from pre-planned questions and that it is important to let participants' concerns emerge in the interview. Flexibility in



interviewing style allows participants to pose questions to each other and to raise issues that are salient to their experiences (Eder & Fingerson, 2002). An unstructured interview schedule ensures that the perspective of the child is captured, rather than the child responding to what the adult thinks is important (Docherty & Sandelowski, 1999). Krueger (1993) recommended using 10-12 core questions for a two-hour interview.

Lewis (1992) suggested that some research questions (e.g. children's perceptions of intra-classroom friendships) lend themselves to having a child interviewer or a teenager conduct the groups. Teen moderators can be effective when interviewing around sensitive topics (Krueger & Casey, 2000). However, teen moderators need training and practice before conducting groups for a research study (Krueger & Casey, 2000).

### **5.3.7 The Focus Group Setting**

Numerous researchers have recommended that focus groups take place in neutral settings such as libraries, community centres, and youth centres, in order to reduce power imbalances (Schuksmith & Hendry, 1998). It is important to take into account how the context of the setting influences the data (Green & Hart, 1999). Green and Hart (1999) found that in the school setting participants followed rules of discussion (i.e. raising hands, turn taking). This made managing children's behaviour less stressful for the moderator, but made facilitating interactive talk difficult.

A practical consideration related to the setting is whether the size of the furniture is suitable for children. If adult-sized chairs are used children may fidget (Vaughn, Schumm, & Sinagub, 1996). Vaughn and colleagues (1996) also recommend that the room be as bare as possible to avoid distraction.

### **5.3.8 Limitations of Focus Groups**

Although focus groups can provide rich data about the perspectives of participants, they may not be appropriate when the goal is to examine an issue in depth. Another limitation of focus groups is that it can be difficult for the researcher to distinguish between group opinions and individual opinions. Lewis (1992) points out that although children may adopt the views of others, it might be the case that children are concurring about ideas and that this represents the salience of the ideas. From a practical perspective, focus groups are more difficult to schedule than individual interviews. Therefore, researchers typically recruit more participants than necessary in order to be prepared in case of cancellations.

### **5.4 Individual Interviews**

In individual interviews, as well as in focus groups, data are created through the interaction of the interviewer with the participants. There are different views about the nature of the data collected depending on the theoretical position adopted. It could be assumed, for example, that in the interview the researcher is uncovering truths about the participant and that these could be independently verified (Smith, 1995). An alternative view suggests that the interviewer and participant are engaging in constructing meaning together (Britten, 2006). There is limited guidance in the research literature on conducting qualitative interviews with children (Docherty & Sandelowski, 1999; Irwin & Johnson, 2005).

A range of interviewing styles can be utilized in individual interviews including structured, semi-structured and unstructured interviewing. Structured interviews are standardized and, therefore, are most appropriate for studies where control and reliability are necessary (Eatough & Smith, 2008). Semi-structured interviews utilize an interview

guide and balance pre-determined lines of questioning with the flexibility of pursuing additional interesting areas that participants bring up during the interview (Smith, 1995). An unstructured style is open-ended in that it does not utilize many pre-determined lines of questioning. This approach is often used in depth interviews which cover only one or two areas, but in great detail (Britten, 2006). With children, individual interviews typically involve a question-and-answer approach, which could include open ended questions followed by direct questions (Docherty & Sandelowski, 1999; Heary & Hennessy, 2006). Irwin and Johnson (2005) commented that some young children have difficulty with open ended questions and, therefore, suggested using closed-ended questions at the beginning of an interview.

The dynamic in individual interviews is different to that of focus groups. In focus groups children can interact with each other, creating an opportunity to develop ideas based on what one hears from peers. However, it has also been suggested that in focus groups children can adopt the views of others without reflecting on whether these views are relevant to their own situation (Lewis, 1992). In some cases, parents might be present during interviews. Irwin and Johnson (2005) found that parents can contribute to young children's interviews by adding a richness and completeness through explaining children's stories or through prompting children about their stories by reminding them about events.

There is some research indicating that children are more forthcoming in individual interviews with regard to personal topics (sexuality and family difficulties) as compared to in group situations (Michell, 1999; Wight 1994). Lewis (1992) suggested that children who are more inhibited may be more comfortable disclosing information in

individual interviews. However, other researchers have suggested that being in a peer situation might facilitate self-disclosure (Kennedy, Kools, & Krueger, 2001). There are limited empirical data to support claims of focus groups with children having more value over individual interviews with children and vice versa (Heary & Hennessy, 2006). In an empirical study, Heary and Hennessy (2006) found no significant difference in primary school age ( $M = 8.4$  years) and secondary school age ( $M = 14.3$ ) students' preferences for individual interviews versus single-sex focus groups. The interviews and focus groups involved children responding to open-ended questions about the causes of behaviour of children presented in vignettes. Analysis of the data indicated that a greater number of unique ideas regarding the cause of Attention Deficit/Hyperactivity Disorder were presented in individual interviews compared to focus groups. Focus groups produced greater elaboration of the topics discussed compared to individual interviews. This is contradictory to suggestions that more in depth information is obtained from individual interviews compared to focus groups. There are advantages and limitation to both focus groups and individual interviews. Thus, the research question needs to be considered in determining whether to use focus groups, individual interviews, or both methods.

### **5.5 Interviewing Children**

When interviewing children, the moderator should be sensitive to participants' communication skills and use language that is appropriate for the age group being interviewed (Charlesworth & Rodwell, 1997; Heary & Hennessy, 2002). Typically, open-ended and nondirective questions are used to facilitate discussion in focus groups (Krueger, 1993). This strategy has been effective in focus groups with children and adolescents (Charlesworth & Rodwell, 1997). Ross and Ross (1984) successfully used open-ended questions to interview children between the ages of 5 and 12 years about

their pain experiences (description of pain, use of coping strategies and using pain for secondary gain). Horner (2000) suggested that focus groups with children are more successful when the children have experience with the topic rather than when they are asked to give general opinions. Therefore, an inverted funnel approach involving moving from familiar or concrete examples to less familiar or abstract concepts was implemented and found to be successful.

It is important to note that even young children (aged 3 to 6 years) have been shown to provide accurate autobiographical recall (Docherty & Sandelowski, 1999). However, Docherty and Sandelowski (1999) suggested that, with repeated events, children develop scripts that describe their general experiences (i.e., particular details from each event merge together). Thus, they recommended that starting an interview with free recall and then following up with direct questions helps to move from a general script to more specific and personal accounts. Different techniques have worked equally well depending on the group being interviewed and on the topic that they are being interviewed about. It is important for a group moderator to be flexible with interviewing style during an interview to match how children are responding.

Question format can influence how children respond. Peterson and Biggs (1997) distinguished between open-ended wh-questions (of the form where, when, who, what) and yes/no questions. They stated that wh-questions are used to request particular information whereas yes/no questions require either confirmation or disconfirmation. When children were interviewed about stressful medical experiences that required a visit to the emergency room, pre-schoolers had difficulty being accurate when yes/no questions were used (Peterson & Biggs, 1997). Peterson and Biggs noted that school-age

children are almost always accurate when answering wh-questions and even two-year-olds are usually correct. Children develop an understanding of and start using wh-questions between two and three years of age.

To find out how question format influences whether children say they do not know the answer to a question, Waterman, Blades, and Spencer (2001) asked children (aged 5 to 9 years) questions about stories, to which children either would know the answer or would not know the answer (i.e., the correct answer to the question would be “don’t know”). Children were more likely to correctly say they did not know the answer when the question was a wh-question than when the question was a yes/no question. This effect was replicated when children were asked questions about a staged event (Waterman, Blades, & Spencer, 2004). The literature on question format suggests that children are more likely to provide accurate descriptions when they are familiar with the topic and when the questions are open-ended (e.g. wh-questions or prompts that encourage the child to provide further information). Another implication of this research is that it will be important to inform children that it is acceptable to say “I don’t know”. Lewis (1992) noted that group interviews make it easier for children to seek clarification from the interviewer, to pose questions, and to express uncertainty.

To increase understanding of questions, Vaughn, Schumm, and Sinagub (1996) recommended providing illustrations. For example, questions like the following could be asked: “Some children like to do something active when they are in pain, like go for a walk. Other children like to do things like lie down. What do you like to do when you’re in pain and why?” Vaughn and colleagues also suggested that asking a negative question

(e.g., “what do you not like about what your parents do when you have pain?”) before positive questions, gives the message that it is okay to give criticism.

In her experience with interviewing children, Eder noted that certain children could tell by the sound of her voice that she was about to end a particular strand of interviewing and that consequently, they would bring up additional ideas before it was too late (Eder & Fingerson, 1996). She found that it was helpful to directly inform children that she was about to end a particular strand of discussion, so that they would have the opportunity to express all that they wanted to before moving on.

To reduce the effect of peer pressure the moderator should create an atmosphere where children understand that it is acceptable to have contrasting view points and where they feel safe sharing these. Horner (2000) notes also that in some cases peer pressure can positively affect the interview. For example, peer pressure is a positive influence when adolescents reveal more than they would in individual interviews because they want to be like peers who are open with sharing experiences (Horner, 2000).

## **5.6 Method**

### **5.6.1 The Researcher**

I approached his research from a constructionist framework, taking the perspective that how children understand and experience growing pains would be influenced by a number of factors including what they believed causes the pain, the impact of the pain, and how others responded when they were in pain. Thus, different children could create different understandings from the same pain experience. The constructionist approach also acknowledges that how children talk about pain and how they experience pain can differ depending on whom they are speaking with.

I was aware of my assumption that so little research had been conducted on growing pains because the condition is considered harmless, and of my bias that in the moment in which they are having pain children might experience some distress. In asking children about their pain I was open to the possibility that there might be no impact of the pain in terms of interference with activities.

### **5.6.2 Sample**

The total sample for study included 19 children (12 males and 7 females) aged from 5 to 12 years (see figure 5.1) and 18 parents (1 male and 17 females). Two of the children were brothers. The sample of physicians that responded to the survey on growing pains in phase I of this research reported seeing children aged 2 to 15 years with growing pains. The peak age range was 3 to 12 years. Children younger than 5 years were not included in the sample as the previously described research on focus groups suggested that focus groups with younger children are difficult to moderate (Smith, Duncan, & Marshall, 2005) and do not produce reliable data (Klein et al. 1992). Criteria for sample selection were based on the results of phase I of this research program. Children had to have bilateral nocturnal pain in the legs occurring in the evening. Because the purpose of this study was to create an inclusive model of growing pains, a heterogeneous sample of children with growing pains was required and, therefore, children who additionally had pain in the arms and/or additionally experienced pain during the day were included in the sample. In addition, children were eligible only if there was no joint pain and no objective signs of disease such as swelling or tenderness. Table 5.1 shows the inclusion and exclusion criteria. Please see appendix E for screening questions that were used during recruitment. One child in the sample experienced unilateral pain according to parental report, but the child was included in the study as



other diagnoses had been ruled out by the child's family physician and orthopedist, and a formal diagnosis of growing pains had been made. The purpose of having unilateral pain as exclusion criteria was to ensure that children did in fact have growing pains and not another condition presenting as growing pains; in this case other diagnoses had been ruled out. In fact, when completing a body diagram, this child depicted bilateral pain, but it is possible that the child (age 6 years) did not fully understand the body diagram.

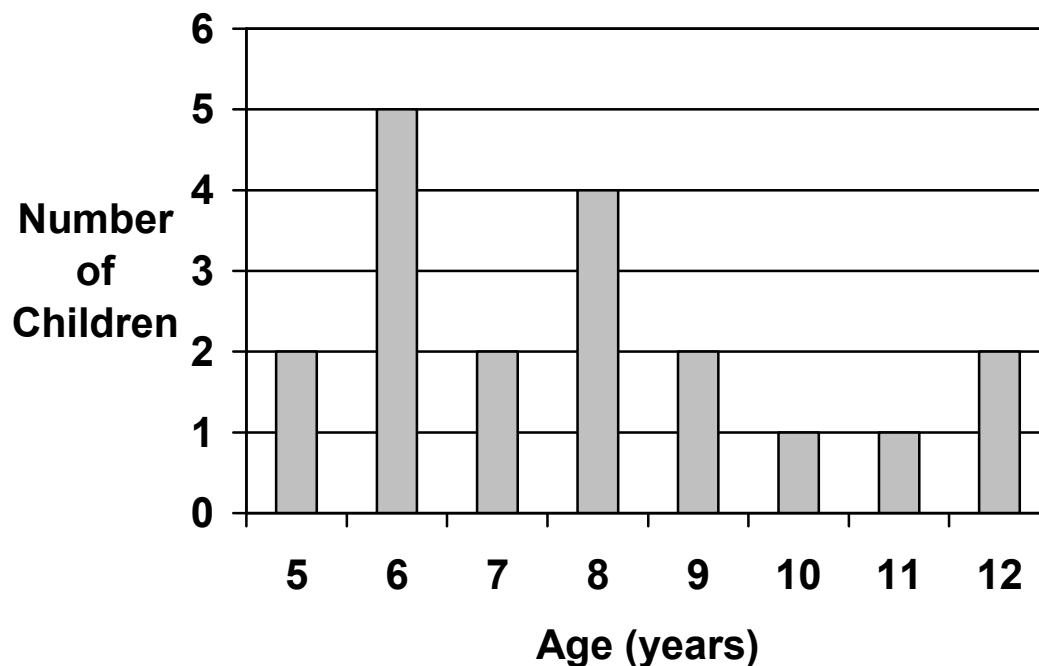
According to parental reports the children in the sample engaged in physical activity for approximately 5 to 30 hours per week, with the majority of children being physically active between 10 and 15 hours per week. The modal number of hours per week that children engaged in physical activity was 14 and the medium was 12 hours.

At least 12 out of the 19 children had at least one parent who had also experienced growing pains. Three parents did not know whether the child's other parent had growing pains. Sixteen out of 19 children (84%) in the study had a first-degree relative who had experienced growing pains. For one child, it was unknown whether there was a family history of growing pains.

Table 5.1 Inclusion and Exclusion Criteria for the Study

Inclusion	Exclusion
Intermittent pain (at least 3 episodes within the past 3 months)	Persistent pain
Bilateral pain	Unilateral pain
Pain in the lower limbs <sup>a</sup>	Joint pain <sup>c</sup>
Pain in the evening <sup>b</sup>	Swelling or tenderness <sup>d</sup>
<p>a. Children who had arm pain in addition to leg pain were eligible</p> <p>b. Children who had pain during the day in addition to the evening were eligible</p> <p>c. Children whose parents described knee pain were eligible as clinically many parents describe knee pain, when in fact the pain is just below the knee</p> <p>d. Although parents were not specifically asked for other objective signs (e.g. limping) if the parents mentioned these, the child would meet exclusion criteria</p>	

Figure 5.1 Age Distribution of the Sample



**Recruitment.** The following recruitment methods were used: posters (see appendix F) at community centers and clinical offices (medical clinics and physiotherapy clinics; see appendix G); advertisements in school newsletters (see appendices H and I) and community newsletters; announcement in a television interview with Global Saskatoon Evening News; announcement in newspaper articles (see appendices J and K); and an announcement on the University of Saskatchewan PAWS Portal. Most of the children were recruited through the media announcements and through advertising in school newsletters. None of the sample came through advertising in clinical centers.

**Theoretical sampling.** In grounded theory methods, theoretical sampling refers to the process of sampling in order to build the theory that is being developed. For example, theoretical sampling could involve seeking out a specific population to further develop a theory. An adequate sample size is reached once the theory is considered “thick” or adequately explicated based on the data. In the current study, data began to be analysed as it were collected and the data did not indicate that there was a need to seek out a particular group of children with growing pains. Thus, sampling in this particular study was not truly theoretical sampling. Instead, data gathering was stopped when no new theoretical insights were gained. However, theoretical sampling was utilized to inform who to select for this study. The sample was determined based on the results from the data collected in phase I of this research, which indicated that the most common necessary diagnostic criteria for growing pains were nocturnal pain and lower limb pain, and that daytime pain and arm pain should not be exclusionary criteria.

### **5.6.3 Data Generation**

It was determined that as the type of data being collected were not of a highly personal nature it would be appropriate to conduct focus groups. Furthermore, as breadth

of data were required rather than in depth information on a specific area of growing pains, it was deemed that focus groups would be appropriate. Individual interviews were conducted in cases where I was unable to schedule a focus group appropriate for the child's age. An analysis was not conducted of the difference between data obtained in focus groups versus individual interviews, as this was not the focus of this dissertation. However, in the process of analyzing data no substantial differences were noted in the types of comments children made in individual interviews versus focus groups. Four focus groups were conducted. Group 1 consisted of four participants, ages 8 to 9 years: one female (age 9 years) and 3 males (two 8-year-olds and one 9-year-old). Group 2 consisted of three participants, ages 10 to 12 years: one female (age 10 years) and two males (ages 11 and 12 years). Group 3 consisted of seven participants, ages 5 to 7 years: 2 females (ages 5 and 6 years) and 5 males (one age 5 years, three age 6 years and one age 7 years). Group 4 consisted of two female participants, ages 6 and 7 years. Three individual interviews were conducted with two males (8 and 12 years of age) and one female (age 8 years). Three of the focus groups and two interviews took place at the University of Saskatchewan. One focus group was conducted at the General Hospital in Regina, Saskatchewan and one individual interview was conducted at the child's home with the parent present. The focus groups lasted about one hour each and the individual interviews were about 30 minutes each. The interviews were tape recorded and with the exception of one individual interview, the interviews were video-taped. The purpose of video-recording was to facilitate ease of transcription for the focus groups and to look for non-verbal data (e.g. pointing to an area that hurts). Data included transcripts of the interviews, interviewer notes about the interviews, and the parent questionnaire. The

parent questionnaire (see appendix L) was completed by parents while their children were interviewed. Parents were asked about their own experiences with growing pains (when relevant) as well as their children's experiences. The questionnaire included both closed and open-ended questions.

The interviews were conducted by myself, with support from research assistants during the focus groups. Children were provided with snacks and juice during the interviews. At the beginning of the focus groups children were introduced to each other and as an ice-breaker exercise they were asked to mention a favourite activity. Finding out about activities is neutral, but it was also relevant to the discussion that occurred on how growing pains impacts activities. After the introductions, children were asked to mark their pain on a body diagram from the Pediatric Quality of Life Inventory<sup>TM</sup>, Pediatric Pain Questionnaire<sup>TM</sup> (see appendix M; Varni, Thompson, & Hanson, 1987). Children were then given a list of pain descriptors from the Adolescent Pediatric Pain Tool (see appendix N; Crandall & Savedra, 2005; Savedra, Holzemer, Tesler & Wilkie, 1993) and asked to circle all the words that described their pain. The pain descriptors were read out loud for younger children. These activities were geared to help children focus on their individual pain experiences. Children were encouraged to use their body pain pictures and word lists to help them describe their pain experiences in the group discussion. The same materials (body diagram and list of pain descriptors) were used in the individual interviews.

A moderator guide (see appendix O) was developed based on gaps in the literature and on the following guiding research questions:

- What do children understand as the cause of the pain?

- Are children concerned about the pain?
- What makes the pain worse?
- What techniques do children use for relieving the pain and do they apply these techniques for other pain experiences?
- What are children told by their parents and in some cases by physicians about the pain? Are they satisfied with these responses?
- Does the pain interfere with activities including sleep?

The guide was used during the focus groups and individual interviews. The funnel technique, which involved starting the interview by asking children to describe their general experiences and following up with more direct questions, was used. Consistent with grounded theory methods, data analysis began as soon as data were collected and, therefore, additional areas of interviewing were pursued in subsequent interviews based on the analysis being conducted. From the initial interviews it became apparent that children were reluctant at times to use medication and, therefore, questions were asked to attempt to find out children's reasoning for when to use medication and when not to. Other lines of questioning that were included after the first interview included the following: what's good about the pain; descriptors for the child's pain that were not on the list presented; how children learnt the pain management strategies they were using.

#### **5.6.4 Data Analysis**

Consistent with grounded theory methods, data collection and data analysis proceeded simultaneously. Initial codes were developed as data were still being collected and, thus, these initial codes were used to guide the content of data that were subsequently collected. Data analysis proceeded through the stages of initial coding, focused and

theoretical coding, memo-writing, theoretical sorting and integrating. These stages were among the guidelines for the grounded theory process outlined by Charmaz (2006).

**Initial coding.** Coding is the process of selecting and sorting data in order to be able to analytically organize data. Charmaz (2006) describes coding as defining what is happening in the data and beginning to determine what it means. I began coding the transcripts of interviews by engaging in line-by-line coding. This involved reading through each transcript and coding each line that appeared to have meaningful data. At this stage I used gerunds (i.e. action words) whenever possible, as recommended by Glaser (1978) and by Charmaz (2006), in order to facilitate coding for processes rather than just content. Based on guidelines provided by Charmaz (2006), initial coding in this study involved moving quickly through the data and comparing data with data (i.e. looking for generalities in the data as well as variations), looking for gaps in the data that I could follow up on, and looking for participants' assumptions and implicit actions and meanings. I asked myself questions about the data such as: what process is this participant engaging in? How does the process develop and how does it change? Who else is involved in this process? What is the outcome of the process? As I was reading text I looked for similarities and differences in the data. For example, I looked for whether children always used the same management strategies for pain or whether strategies were different depending on the situation and time of day.

**Focused and theoretical coding.** After creating initial codes I went through the data to select and synthesize initial codes in order to categorize the data in conceptual categories. I then compared my data to these categories to ensure that my codes captured what children had said and the processes inherent in their beliefs and actions. Theoretical

coding involved identifying the possible relationships between categories. To look for relationships I utilized some of the concepts in Glaser's (1978) theoretical coding family labeled the "Six Cs" - Causes, Contexts, Contingencies, Consequences, Covariances, and Conditions. I looked at the conditions under which growing pains occurred, the conditions under which it changed, children's understanding of the cause of growing pains, children's strategies for dealing with growing pains, and the consequences of their actions.

**Memo-writing.** As I was coding I started writing memos about what I was perceiving in the data and about questions I had about the data. After the initial focus group, my memo helped me to identify themes to follow-up on in subsequent groups and individual interviews. As I engaged in focused and theoretical coding I wrote advanced memos about the category by outlining its properties and identifying the data I had that supported the category, that is, I incorporated raw data into my memos. Additionally, in my memos I compared categories to see which categories could stand alone and which fit together. I wrote about how categories were related. As I wrote my memos I kept track of which ideas had solid support in the data and which ideas needed to be explored further. I used the following two strategies, outlined by Charmaz (2006), to write my memos: clustering, that is, visually mapping out codes and the relationship between codes and categories, and free-writing. My memos helped me to analyse what was happening in the data and to raise codes to conceptual categories.

**Theoretical sorting and integrating of memos.** The final stage in analysis involved identifying how memos and categories fit together and was conducted after all the data had been collected. This was done by sorting memos according to category and



then comparing categories. If relevant, new memos were written. Several ways of sorting and integrating the memos and categories were examined. I drew diagrams to look at different sorting arrangements and this helped me to see which categories fit together and which did not, as well as to refine relationships between categories. The final model was the best plausible theoretical account that fit the raw data.

### **5.6.5 Criteria for Evaluating the Study**

In grounded theory research criteria for evaluating the quality of the work include credibility, originality, resonance and usefulness (Charmaz, 2006). Credibility is determined by whether the claims made in the theory are logically linked to the data. In order for this to happen, the categories have to cover a range of observations, there has to be depth in the data, and there has to be enough evidence provided for the reader to reach similar conclusions. I addressed credibility by using the constant comparative method during the analysis procedure to determine alternative possibilities in participants' behavioural actions and in their implicit processes. In the results section I have provided excerpts of raw data to enable the reader to see the links between the data and the theoretical model.

Originality occurs when the analysis is conceptual rather than just a description of the data, and when the grounded theory "challenge[s], extend[s], or refine[s] current ideas, concepts, and practices" (Charmaz, 2006, p.182). The analysis is conceptual in that it provides a model of how participants experience growing pains, that is, how their meanings and actions are constructed.

Resonance occurs when the categories convey the fullness of the experiences of participants, when the theory makes sense to participants, and when taken for granted meanings are explicated. In this research, the model was not presented to participants or

to their parents and so the best way to evaluate whether participants would resonate with the theory is to determine how well the categories map onto the raw data.

Usefulness refers to whether the analysis offers interpretations that people can use, whether the analysis can spark further research, and whether the work contributes to the body of knowledge. The implications of this analysis are presented in the discussion section of this chapter.

#### **5.6.6 Ethical Considerations**

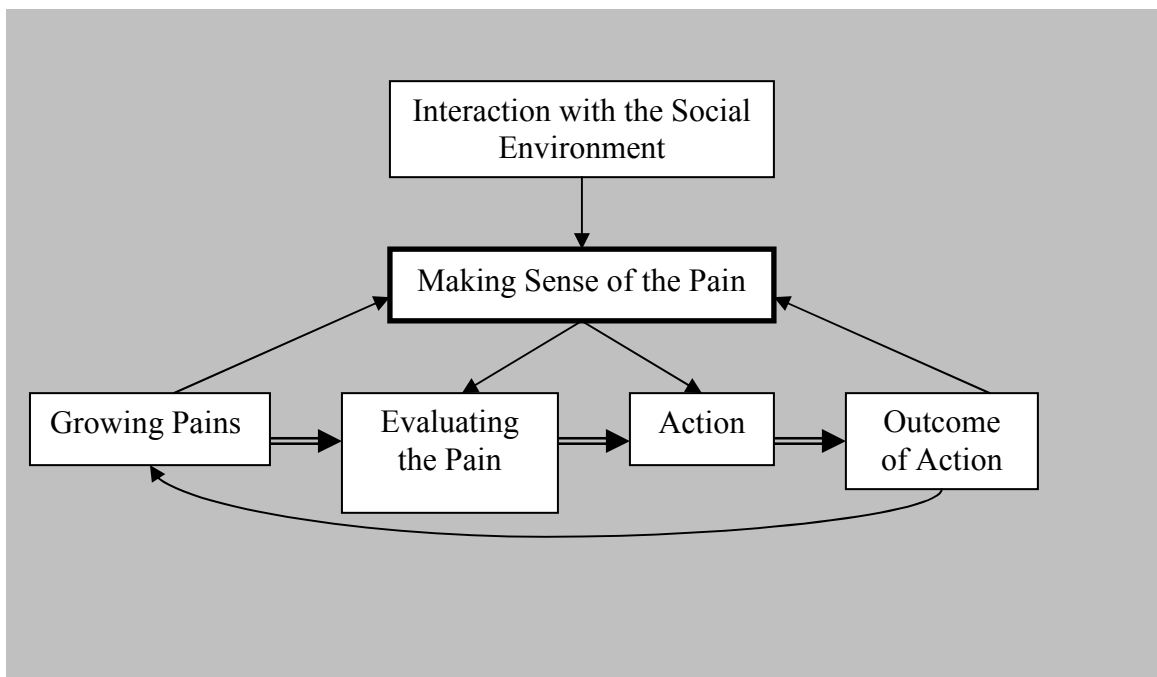
Ethical approval for the study was obtained from the University of Saskatchewan Behavioural Research Ethics Board (see appendix P). Informed consent (see appendices Q, R, & S) and assent (see appendices T, U, V, & W) were obtained from the parents and children respectively. The aims of this research, and how the information provided would be used, was explained in developmentally appropriate language. Children were informed that they could change their minds at anytime. Parents and children were informed that the identifying information would not be reported, but that it was possible that other group members might talk about the information discussed in the focus group. The focus group was conducted by myself, a person with experience in interviewing children in the context of clinical work.

### **5.7 Results**

The nature of the data collected lent itself to development of a theoretical process model of how children experience growing pains, rather than simply a content summary of children's experience. As categories were developed and integrated, it became clear that participants engaged in a process of meaning-making or making sense of their pain. This core process guided how they experienced growing pains in terms of their perceived ability to cope with the pain and their actions in response to the pain. The model,

presented in figure 5.2, consists of six interrelated categories, with Making Sense of the Pain as a core category. Each category is described below with excerpts from the interviews to illustrate the categories. Pseudonyms are used in these excerpts. The excerpts provided are not comprehensive and are not repeated though they may illustrate more than one category; they are provided for the purpose of illustrating how the categories are linked to the raw data.

Figure 5.2 A Process Model of How Children Experience Growing Pains



### 5.7.1 Category: Making Sense of the Pain

Children made sense of their growing pains based on their interpersonal and intrapersonal experiences with growing pains. Making sense of the pain refers to a process of creating a personal framework to understand the experience of growing pains. The framework includes what causes the pain and or/what triggers it and what makes it worse, and what helps to alleviate the pain. This framework is not static, but rather it is

evolving. New encounters with their environment and new experiences with growing pains contribute to the framework that children create. Their understanding of their pain directs how they respond to the pain.

Children's understanding of what causes the pain was created based on their personal experiences with growing pains, and on what they had been told about growing pains. Tony (age 8), for example, adopted an explanation given to him by his parents: "Because I don't drink enough water....My parents told me." In some cases, what children were told about the cause of their pain did not match their own observations and children came up with their own interpretation. Kate (age 10) had been told by her family physician that her pain was due to growth. Her mother had informed her that the pain was related to physical activity. These explanations did not make sense to Kate in light of her own observations:

Like well she said [the family physician] it was growing pains but I didn't really think it was because I measured myself for some odd reason and I was like smaller or something or maybe it was just the way I measured myself...I think it happens, well my mum says it happens because of physical activity and, but I haven't been in much because lots of my teams got cut because not enough people signed up so I don't know what it is. I think it's just when I'm tired, over tired...I don't think it's growing because I don't really, well sometimes I'm convinced that it is growing, but sometimes it makes me think like, 'cause I don't exactly know if I grow all the time and I think that I do so I think it would happen all the time, but it's just the fact that it just happens usually at night so I don't think that it is.

The following excerpt highlights the evolving nature of making sense of the pain experience. Steve (age 6) starts off by attributing the pain to growth, but goes on to link the pain to a former sports activity.

Well, it's a growing pain so I think it's just pain when I grow because I used to take karate. We used to have to kick a lot, run a lot and do stuff a lot, but I umm didn't like it because it always made my arms, my legs and my ankles hurt, so I think the pain is just probably my karate class. It's like a hard class to kick. It's from my karate class came to get revenge on me.

In making sense of their pain experience, children incorporate information from social narratives, that is, understandings about pain that they have heard from parents, friends, or the media. This was particularly salient when children spoke about their use of medication. Despite commenting that medication was helpful, children preferred to either tolerate the pain, hoping for it to resolve quickly, or used other strategies for managing their pain before resorting to medication. Use of medication was reserved for increased pain severity. Kris (age 8) commented that he knows to use Tylenol “when it [the pain] really really hurts” and stated that his pain would need to be an 8 on a 10 point scale (with 0 being no pain) for him to take medication. This theme was echoed by others, both males and females. Simon (age 11) stated: “well usually it’s really bad pain then that’s usually I can take a little bit of pain, but when it gets real worse I know to take it [medication].”

The following is a list of children’s theories about the cause of their pain: growth, increased or strenuous physical activity, decreased water intake, “sleep[ing] too good,” related to an old injury, genetically predisposed, being over-tired. Increased activity or strenuous physical activity was the most frequently cited cause of growing pains, followed by growth. Parents who had growing pains as children attributed their pain to growth, increased activity, and decreased calcium intake. Among parents, the most frequent cause to which they attributed their child’s pain was physical exertion. Other causes for the pain that parents speculated upon included the following: dehydration, not stretching before activity, growth spurts, footwear, malalignment, weak bones or cartilage, and change in the weather. Children’s views of triggers for their pain

are further described in the section on the category Action, as are children's understandings of what helps to alleviate their pain and what makes it worse.

### **5.7.2 Category: Growing Pains**

This category reflects children's descriptions of the location, quality, duration, and time of occurrence of their growing pains. Children incorporate this information into their frameworks for understanding their pain. For example, Rori (age 8) incorporated information on when her growing pains happen to help her develop an explanation for her pain: "Usually on Tuesdays and Thursdays I go to soccer practice and then on Thursday night (inaudible) ...on Thursday night I have this big humongous growing pain on like that day (inaudible)... and it really hurt. I was like screaming and I was yelling." In turn how children make sense of the pain influences their actions. Outcomes of actions inevitably include an impact on the sensory and emotional aspects of growing pains. For example, Kate (age 10) experiences a thumping sensation when she focuses on both her pain and the beat of music that she is listening to as a way to help her cope with the pain. Children described how the outcome of the action of taking medication is a reduction in pain duration and intensity.

The location of pain remained the same for some children, and for other children, the location varied. Children in the sample described experiencing growing pains in at least one of the following areas: around the knees, back of the knees, feet, calves, shins, thighs, ankles, and arms. Some children always experienced pain in the same location, though bilaterally, while others experienced pain in different locations. Some younger children had difficulty pinpointing the location of their pain: "Sometimes I don't even know where it is and it's like everywhere, every time it changes on my body" (Carol, age 6). Other children were very specific about the nature of their pain. Kate

(age 10) noted that for her “the right hurts in the daytime, but the left hurts in the night.”

For Rori (age 8), location of the pain was linked to severity of pain. When she had pain in both legs, she experienced increased pain severity: “it’s really worse because its like double times the hurt.”

Children identified with a number of descriptive words presented to them that might describe their pain. The words that best described their pains included: annoying, stiff, horrible, achy, sore, cramping, continuous, and throbbing. In addition to the words presented, children came up with their own descriptors which included the following: squeezes, bad, and uncomfortable.

Based on the words presented, younger children spontaneously used metaphors in describing their pain:

- It feels like a troll’s hitting me with an axe... Sometimes it feels like a bee stung me, sometimes it feels like someone stabbed me, sometimes it feels like I have eyes on my ankles and someone punched me... like someone made a big hole and then pulled the eyes out of it (Steve, age 6)
- It makes me feel like I’m dead (Bryce, age 6)
- It’s like somebody made a hole in my leg and put fire in it (Shaila, age 6)
- Ten thousand elephants stepping on my leg (Brad, age 6)
- Feels like I got shot too many times (Jason, age 6)
- It’s like when someone stabs me right there [back of knee], (Jacob, age 5)

A few older children also used metaphors to describe their pain. Kate (age 10) stated: “It feels like there’s no skin and someone’s ripping out my bone.” Rylan (age 12) said his pain “feels like somebody punched my knee cap or I fell off my dirt bike and it, my knee

cap, got pushed to the side a lot and it broke it and it really hurt.” Rylan described a recent episode of pain, when he was trying to fall asleep, in the following manner: “it feels like it’s my knee just wants to sink it but it can’t and it, I don’t know what it feels like it just really hurts. It just really really really really really hurts.”

Most children described the pain as intermittent, with the exception of two younger children (Bryce and Steve, both aged 6) who said they have the pain everyday. Some children said the pain lasted for hours or even days. For some children the intensity of pain was linked to the type of activities they had been participating in. Simon (age 11) noticed that increased activity was linked to increased pain duration: “well it just depends like what I’ve done. If I’ve been running real hard or something it usually lasts a couple of hours and days if I run real hard.” Evening or night time pain was common, but a few children occasionally also had pain during the day, including while they were at school. Some children had pain in the morning prior to school and some experienced pain when they returned home from school: “well mine comes in on the day after I come home from school, but then it goes away quicker than in the night” (Kate, age 10). Among those children who experienced pain at school, some recalled having pain at recess. It is possible that the pain had started earlier, but that because at recess the pain interfered with play activity, children were more likely to remember these incidents of pain.

### **5.7.3 Category: Evaluating the Pain**

When children experience growing pains they engage in a cognitive process of evaluating their current pain experience. This includes comparing the current experience to past experiences, evaluating how the pain feels and how they feel about it, evaluating their ability to manage the pain, evaluating whether the pain is interfering with activity or



is likely to, and evaluating the potential impact of actions they might engage in. Thus, children's frameworks for the pain are taken into account in their current evaluations. Based on this evaluation, the child determines whether an action is needed and if so which action to engage in. The action the child engages in is influenced by his or her prior experience, the current situation, and the child's evaluation of their own self-efficacy in coping. Jack (age 8), for example, described the pain as frightening because it would not go away. It is plausible that if Jack evaluates that he cannot cope with the frightening pain and that it will not go away on its own, he is likely to seek help from someone else rather than attempting to manage the pain himself. Tracy (age 7) described feeling that she cannot do anything about her pain when it occurs at night. Consequently, she has to immediately seek help: "Actually I can't really do anything. In the night I usually cry... I don't wait at all, I just get up to go, I have to hurry to the bedroom [to get her mother] before it really starts hurting even more." The influence of perceived lack of control over pain might be mediated by the child's store of knowledge of coping techniques. Kate (age 10), for example, recalled an incident in which she perceived having no control over pain, and yet, her framework for understanding pain included knowledge of the benefit of keeping her mind off the pain facilitating her coping with her pain: "It was just, it wasn't stiff, it felt like there was no bone in it and it was just everywhere and it felt like there was no bone and I had no control over it...it went away really soon...I just kept watching TV...well it kept my mind off of it."

Children described the pain as interfering with physical activities and with sleep. In terms of physical activities, children typically experienced an impact in their performance abilities. For example Judy (age 9) stated: "I can't kick as hard at Tai Kwon

Do” and Adam (age 9) noted: “I can’t kick a football once in a while.” In some cases, children stopped participating in physical activities or chose not to engage in physical activity because of their evaluation that they could not be active while in pain. For example, Rori (age 8) described an incident when she did not participate in gym class: “I couldn’t play dodge ball because my legs hurt and we were playing dodge ball and I couldn’t run or anything or dodge or anything and I had to sit down on the bench.” Kris (age 8) noted an incident when he could not participate with friends at recess because his legs were hurting. Kate (age 10) said that having growing pains interferes with playing “because it feels like I’m I just can’t move.” Some children reported incidents of when they had difficulty walking because of their pain. Rori (age 8) described an incident when she had growing pains while she was at a shopping mall: “I was walking all around the mall and it made my pain worse because it was feeling because my legs hurt and I had to sit and I had a growing pain and it felt and my growing pain felt the pain and it was like ah and it made it worse.” Steve (age 6) said that sometimes the pain interferes with walking: “I can’t walk because of the pain and I have to crawl like a little baby...that’s embarrassing to say.”

Children described the pain as interfering with falling asleep and with waking them from sleep. To cope with the pain at night, children sought help from their parents and in some cases tried to manage the pain themselves. Tony (age 8), for example, described an incident at night when he sought help from his parents: “I went and woke up my parents...they gave me Tylenol and massaged my leg.” Judy (age 9) wakes up at night approximately once a week from pain: “I usually try to walk to the washroom and get myself Tylenol or I go into my mum’s room and tell her.” Steve (age 6) described the

impact of poor sleep: “I’m like um, what’s the matter in my ankles, and then I wake up and then I try to go back to sleep. Can’t go back to sleep and then I just get up and call up my parents...and then I’m tired through the whole day.” Some parents also commented in the parent questionnaire on the difficulty their children had in sleeping when they had growing pains: “sometimes she can be up for 1 to 2 hours and will be fatigued the next day and has missed school.”

#### **5.7.4 Category: Action**

In response to their evaluation of the pain children took action. Actions included choosing not to do anything specific to attempt to alleviate the pain, engaging in a pain management action either individually or with help, and seeking support from parents. Specific pain management actions included stretching, walking, application of heat or cold, massage, laying down, taking medication, and distraction. Actions taken were inevitably influenced by how children made sense of the pain. Part of a child’s framework for understanding the pain included their knowledge of the outcome of past actions. Children engaged in actions that had been successful in the past or in actions that were initiated by family members or caregivers.

The following case example highlights how meaning-making or making sense of the pain influences the action taken. Tony’s (age 8) framework for understanding the pain included a temporal aspect to pain management. He had observed that engaging in pain management sooner rather than later helped with alleviating the pain: “well, the sooner I take medicine and my dad massages it, then the sooner it goes away.” However, his framework for understanding the pain also included the meaning that taking medication held for him. Despite his understanding that taking medication sooner rather than later makes the pain go away faster, Tony was reluctant to take medication right

away, stating that he waits first to see if the pain goes away without the use of medication.

The following case example highlights how evaluating the pain at the time it is occurring as well as the child's current framework for understanding the pain influences the action taken. Tracy (age 7) finds that her mother rubbing lotion on her legs helps to get her "mind off it [the pain]." Tracy described a situation at school when she had pain while she was outside for recess. In her evaluation of the pain, Tracy thought that the pain was severe enough that she would not be able to continue to walk. Therefore, she needed to do something about the pain, and based on her experience with her mother rubbing her legs, her framework included the knowledge that pain can be relieved by rubbing. So, Tracy rubbed her own legs in order to be able to resume her activity.

**Stretching.** Children who engaged in stretching as a pain management strategy while they were in pain had either learnt about this strategy from parents, simply tried it and discovered it was helpful, or had stretched in the context of sports and discovered stretching was helpful for pain management. Most of the children stretched while they were in pain as opposed to stretching on a regular basis. Some children were reminded to use this strategy by their parents. Children who stated that stretching on a regular basis was helpful, stretched as part of a warm-up activity for gym class or as part of extracurricular sports activities. One child who had tried stretching while she was in pain had not found this strategy helpful and, in fact, found that her pain increased when she stretched.

**Walking versus laying down.** Some children found that walking made their pain worse and others noted that walking was helpful, though it could hurt initially.

Mary (age 5) described finding it difficult to walk upstairs sometimes when her legs hurt: “when my legs hurt I try to go upstairs, but I can’t so I stay downstairs and try to tell my mum to rub my legs...she doesn’t hear me sometimes so I have to like yell.” Some children found that laying down or sleeping when they had the pain was helpful. Luke (age 12) commented that he gets relief from taking the weight off his legs by sitting down.

**Application of heat and cold.** Application of a heating pad or a hot water bottle and taking a warm bath were described as pain management strategies. Some of the children had not tried using heat, but had heard of others (parent, babysitter, friend) using heat. Some children used this strategy without help from their parents, while others noted that their parents prepared the heating pad or hot water bottle and applied it to their legs. In cases when a hot water bottle was not available, other strategies involving application of heat were used. Rori (age 8) described what happened when she had pain while she was away from home at a hotel:

I had these, my two growing pains right here and they gave we didn’t have any hot water bottles or anything so they gave me like a hot wet cloth and I lay them down on my legs like this and I turned my legs like that I was just laying back ...I was just watching TV and I just fell asleep.

Application of cold or even simply feeling cold was noted as a pain management strategy. Kate (age 10) described how she was able to manage her pain at school simply because she was very cold: “I just came in from recess and it was, like it was like frozen, so it was really cold and like I couldn’t feel it.” Steve (age 6) uses an ice gel to help him manage pain: “We have this icing that has local and then sometimes I wake up and ask my dad to get it for me and we put it on my ankles and then I go to sleep and after (inaudible) my pain is gone.” Rylan (age 12) uses a cold water bottle as suggested by his

mother: “I tried hot blankets and it kind of helped, and then I tried a hot water bottle at home and it helped a lot, and then I tried a cold water bottle and it helped the most.

**Massage.** Children either massaged their own limbs or their parent massaged the limbs in order to alleviate the pain. Kris (age 8) noted that he obtains relief quickly, within 5 minutes, from his father massaging his legs. In contrast to this, Judy (age 9) reported needing to massage her own legs for approximately 30 minutes before her pain goes away. Jack (age 8) finds that massage helps to take his mind off the pain, but that it does not make the pain completely go away. Mary (age 5) has relief from her pain when her mother “rubs it [her legs] carefully and gently.”

**Medication.** The brands of medication mentioned by children included Tylenol, Motrin and Advil. Children either got the medication themselves with prior approval from their parents to take medication for growing pains (children aged 8 and older), requested medication from their parents, or were given medication when they informed their parents about their pain. Rylan (age 12) learnt to take medication himself after his mother initially gave him medication: “It was in the middle of the night and it just came and it really hurt....Mum gave me Tylenol...I take it all the time now when I get it...takes about five minutes because that’s the longest I’ve stayed awake until before falling asleep.” Among the strategies that Rylan uses to manage his pain he finds that taking Tylenol works the best, but he uses other strategies if Tylenol is not available: “Well cold water bottle is a, what’s it called, back up plan I guess because if we run out of Tylenol then we get the cold water bottle.” Judy (age 9) noted that she was woken up by her growing pains at 1:00 a.m. In evaluating her pain, she came to the conclusion that she needed to do something about it. Typically, she would ask her mother for help, but

her sister was sick and was sleeping with her mother, so Judy came up with an alternative strategy: “Well, I went and I got myself Tylenol because everyone was still sleeping and my little sister was sick so I didn’t want to wake her up.” The length of time between children taking medication and experiencing relief varied from 5 minutes to hours. They take medication when the pain gets worse, if other strategies do not work, when they cannot sleep, or when a parent tells them to take medication. Kate (age 10) provided an example of a sequence of how she attempted to cope with pain without initially using medication: “Well usually if it hurts then I can’t sleep. I go into her [mother’s] room. She rubs it for a while and then she asks, she’ll ask if it goes away and if I say no, then she’ll tell me to take Motrin.”

**Distraction.** A variety of distraction techniques were described by children. When Simon (age 11) has pain at night he engages in distraction to help the pain alleviate so he can sleep: “I usually just try and do something that would keep me busy and it just goes right off...listen to music or something...um sometimes I play like a game cube or something for a little bit and then it’ll help and it’ll go.” Kate (age 10) also finds listening to music helpful when she is in pain, but uses the music as technique to help her focus on the quality of the pain:

Sometimes I listen to my mp3 player or and like it when I listen to it, kind of like to the beat of the music it kind of thumps and like feels like something’s like stabbing it....like they hurt but they feel good. Some people have that and I have that. It just it’s kind of in between like it’s still there, but it kind of feels better.

Rori (age 8) distracts her mind from the pain when she is in bed by focusing her attention on her hamster “running on his really squeaky wheels.” When asked about alternative strategies, she noted that if watching her hamster did not work she would “turn around and then close my eyes and then just think of happy things.” Luke (age 12) finds reading

helpful as a distraction technique when he has pain. One of the parents commented that she helps her child with distraction by putting on a story tape for the child. Rylan's (age 12) mother commented that although distraction through reading, music, or television can be effective, these kinds of distraction techniques are not suitable for use when Rylan has pain in the middle of the night.

#### **5.7.5 Category: Outcome of Action**

An action can be successful, unsuccessful, or partially successful in achieving its goal. How the action worked becomes part of the child's framework for understanding the pain. Goals of the actions described by children were usually to relieve pain in order to experience relief, to be able to sleep, or to continue an activity. Outcomes of an action include not only whether the goal was achieved, but also the coding of how successful the action was. Children continued to use actions that were successful in their endeavors to manage pain. Not only did they use successful actions to manage growing pains, but they also used these actions to manage other types of pain. For example, Rylan (age 12) was given a cold water bottle by his grandma to help him manage his growing pains and he discovered that placing a cold pack on the area where he had pain was very helpful. The outcome of this action was not just immediate pain relief – Rylan encoded cold as a pain relief strategy in his framework for making sense of his pain, and subsequently, used cold treatments to manage acute pain from injuries: “When I fall I put a cold water bottle... and if I sprain my finger I just dip it in snow.” When Kate (age 10) has headaches she uses strategies of distraction and medication which she learnt to use in managing her growing pains: “Sometimes I walk around and it takes my mind off it or sometimes I'll just take Motrin.”



One of the outcomes of successful actions is that children can then educate others about what helps them. In order to solicit support in relieving their pain, children sometimes educated others about growing pains and about actions that they had previously taken that were successful in managing their pain. For example, Rori (age 8) informed her teacher about her pain: “I said teacher I have a growing pain in my leg. She’s like ‘what the heck is that’ and I told her.” Rori also described educating her grandparents about giving her a hot water bottle when she has pain.

#### **5.7.6 Category: Interaction with the Social Environment**

How children made sense of their pain experience was influenced by their interactions with others, including peers, family, and medical professionals. Children’s frameworks for understanding their pain is also influenced by their knowledge of popular social narratives about pain and medication use, which they have been exposed to through media and through interactions with others. Children’s actions of reserving medication for what they deemed intolerable pain was reflected in some of the parents’ comments about medication use. Some parents noted that they did not give medication unless other methods were not effective. Other parents commented that medication use was acceptable occasionally and that it helped their children with sleep and resuming activities.

The influence of peers in communicating pain was evident in one of the groups, when one child created a metaphor for his pain, and then other children began to create metaphors along the same lines. Peers also influence how children attempt to cope with the pain. Adam (age 9), for example, does not look to his teachers for support when he has pain at school, but turns to his friends:

I don't really tell my teacher, I just go out and play. But, when, usually when it's hurting I'll sit and talk to my friends and that's, and then, then it's usually we'll stretch and then we'll go play...well, I usually say that my leg muscle hurts and they'll say well, why don't you just stretch or something.

Kate (age 10) decided, after hearing another group member talk about his coping strategies, that she might also try having a warm bath to manage her pain: "I might try taking a bath 'cause my mum said when I was a baby that when I was crying or something, taking a car ride or just calming down or taking a bath would help."

Additionally, peers likely influence each other's understandings of the cause of the pain.

For example, in one of the focus groups, Jacob (age 5) suggested that he has the pain because he sleeps well. Bryce (age 7), however, made the suggestions to Jacob that sleep does not cause the pain: "that shouldn't cause the growing pain if you sleep too good...It's not because it's like sleeping helps your growing pains, it stop having pains."

Parents, family members, caregivers, peers, teachers or coaches, and medical professionals pass on their knowledge about growing pains to children either through directly communicating their theories of causation or through directing children in how to manage their pain. Rori (age 8), for example, described how her mother has informed her about growing pains:

I thought the first time that I had the growing pain that it was just another pain, but then it kept going off and on and my mum told me more and more about it ...and I was like this just gets worse every year.

Rori uses distraction to manage her pain and she likely learnt about doing this from her mother who she says attempts to help her take the mind off her pain: "it hurts so much and whenever I fall asleep I can't take my mind off it and my mum just tickles my back or something so I can fall asleep so then I have my mind off of it." Rori has also been informed about growing pains by her babysitter. Rylan (age 12) noted that he initially

thought “I hurt something in my legs or something was going ah” and then his mother provided an explanation and name for the pain he was having. One of the parents reported telling her child that she needs to drink milk when she has the pain because the milk will make her bones stronger. This implies to the child that weak bones are a cause of the pain. Carol (age 6) said when she has pain her mother tells her what to do: “my mum just said that you’re supposed to put on a pack on the bone.” Luke (age 12) is encouraged by his mother to self-manage his pain: “She just asks me what I want to do. Like have a bath or just go to sleep.” Judy (age 9) is directed by her mother to lie down while her mother gets her Tylenol. Judy described how her gym teacher attempts to help her when she has pain: “he maybe gets an ice pack to see if that helps.” Judy’s family physician has also directed her in how to manage her pain: “she just said that I should stretch a little bit before I run a lot or before I kick like super hard or swim.”

Parents’ own theories about growing pains and how to manage it were in turn constructed through their social interactions, including through the media, and in some cases through their own experiences with growing pains. Rylan (age 12) learnt to massage his own legs because his mother massaged his legs and he found this helpful. His mother said that she learnt this strategy from her parents who would massage her legs when she was a child with growing pains. Similarly, Jack’s (age 8) mother attempts to help Jack by encouraging yoga stretches, based on her theories about the pain and based on her own experiences with pain.

Children also learn about how to manage pain through observing others. Luke (age 12) manages his pain by being inactive. Notably, his sister had growing pains when

she was his age and Luke stated that “she didn’t really talk about it, but she’d just go to her room and not come out.”

There can be an emotional component to children’s and parents’ interactions around growing pains. Some children experience reassurance from hearing that other family members also had growing pains. When asked what is good about the pain, one child mentioned that her parent’s response shows that they care about her. One parent mentioned that at times her daughter tries to seek attention through mentioning that she has growing pains. In a conversation with a parent who was not involved in this study, the parent noted that she did not know what the pain her child was having was and had actually taken time off work to be with her daughter. Kate (age 10) described what she feels like when she wakes her mother up because of her growing pains:

Well sometimes it feels like, I don’t know, not exactly like she wants me to be there but, like she wants me to go away or something ‘cause she doesn’t want to listen to it ‘cause it makes her hurt or something, and usually it’s like I said it in the morning and so she wants to go back to bed.

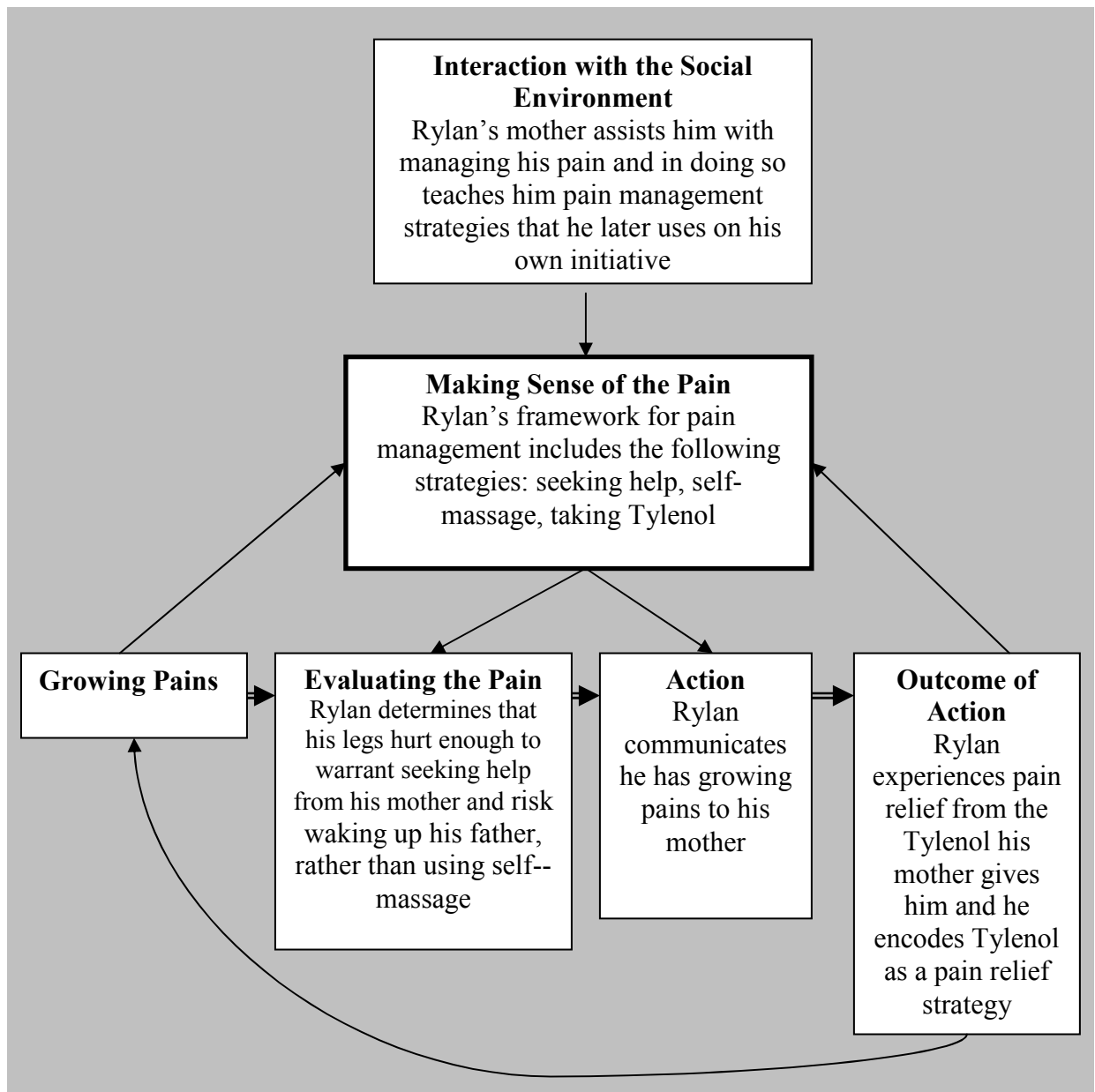
Parents commented about the difficulties their children had with sleep when they had growing pains and one parent particularly commented on the emotional impact: “As a parent of young children - to be yanked out of a sound sleep to deal with growing pains in the middle of the night - it can be an effort to express compassion when you’re not fully awake or when the child is particularly whiny. As a parent you try your best but it can be difficult at times.”

### **5.7.7 Case Example**

The following is a case example of how the model fits the data from the interview with Rylan (age 12). Rylan used the metaphors of being punched in the knee or falling off his bike and breaking his knee to describe the pain he experiences around

his knees. At the time of the interview he was also experiencing pain in his back. In trying to make sense of why he was experiencing back pain, he wondered if this was also growing pains. But, he was informed by his mother that his back pain was not growing pains. Rylan described an incident when he experienced growing pains during the night. In evaluating his pain, he noted that his legs “really hurt” and so he needed to engage in the action of seeking help from his mother. His mother gave him Tylenol, which he found helpful in alleviating his pain. The outcome of this action was that Rylan encoded Tylenol as a pain relief strategy in his framework for understanding pain and now often takes Tylenol to help him sleep when he has pain. Sometimes he tries to manage the pain without medication, because in his evaluation he determines that he would rather not get out of bed to get his mother to give him medication and can cope without doing so. In these instances, Rylan uses other strategies that he has encoded in his framework for managing pain, such as massage. Rylan learnt about massage from his mother, who learnt this strategy from her own parents. Rylan also sometimes decides not to shout out for help when he is in pain because he does not want to wake up his father who he thinks will “get mad” and tell him to go back to sleep. If Rylan’s self management techniques are not working, and his pain is becoming intolerable, he calls his mother. Figure 5.3 illustrates the process model of growing pains based on a particular pain episode described by Rylan.

Figure 5. 3 Case Example to Illustrate the Process Model of Growing Pains



## 5.8 Discussion

### 5.8.1 Conclusions & Clinical Implications

Growing pains has been viewed as a benign pain because it is assumed that the pain disappears in adulthood and that there are no repercussions to having experiences of

growing pains. However, the process model of growing pains developed in this research implies that children develop a framework for how to understand and cope with pain based on their experiences with pain and their interactions with others around their pain. This framework has implications for how they might manage coping with other types of pain experiences and how they might manage pain as adults. The ideas of learning from pain experiences and of the social influences on pain experiences are not new, but there has been no research prior to this examining how children process their experiences with growing pains. Furthermore, there has been no research to my knowledge prior to this supporting the idea that children develop a framework for managing specific pain experiences based on their experiences and interactions, which they then apply to other experiences of pain.

Consistent with approaches to grounded theory analysis, the fit of existing models of pain to the current model were examined after the data analysis in order to ensure that the model that was developed fit the data, rather than attempting to force the data into an existing model. The evaluation component of the current model is substantiated by research on the pain experience of children with hemophilia. Spitzer's (1993) interviews with children with hemophilia indicated that children engaged in a self-assessment process to determine the severity of a situation based on their pain. The current research expands what we know about children's self-assessment by showing what influences their assessment and how the assessment influences their actions. Craig (2002) proposed a sociocommunications model of pain that describes the interaction between the pain experience (thoughts, feelings, sensations), pain expression, assessment of pain, and actions taken by caregivers. This model focuses on the assessment of pain

and subsequent actions or interventions implemented by others. The current model focuses on how children evaluate their pain experience and the consequences of their evaluations, as opposed to how others assess their pain experience. The process model of growing pains is consistent with the sociocommunications model in highlighting the influence of social context. Data from the current study support the notion of intergenerational transmission of knowledge about pain, as described by Craig (2002), and is consistent with research indicating that mothers transmit information to their children regarding pain management including medication use (Hatchette, McGrath, Murray, & Finley, 2006).

The process model of growing pains implies that to facilitate children in self-managing their pain, we need to intervene at a level that impacts how they make sense of their pain and hence, impacts their framework for pain. The process model indicates two avenues which impact children's frameworks for pain – interactions with their social environment and the outcome of actions. At the level of interactions with others and with media, professionals and parents can intervene by educating children about their pain and about how to manage it. One avenue for education is printed material. The Arthritis Research Campaign in the United Kingdom published a booklet about growing pains for children aged 5 to 10 years (2005). One of the difficulties in developing educational resources is the lack of evidence-based knowledge about growing pains. To manage this, it is recommended that the material prepared for children focus on intervention strategies rather than explanations for their pain. The current research suggests a number of intervention strategies that can be accurately cited as strategies that children have found helpful. In addition to the currently recommended interventions (heat, massage, and



medication), children in this study noted finding distraction techniques and stretching helpful. Parents could facilitate their children in coping through encouraging use of self-massage, distraction strategies, and regular stretching exercises. In describing using stretching as an intervention strategy, it was clear from children's responses that they needed to be reminded regularly to stretch. Although there is not strong scientific evidence to suggest that stretching is helpful, it can be argued that there is at least as much evidence for stretching as there is for other strategies like massage. The common strategies for managing growing pains have been suggested because of theoretical and anecdotal evidence. We now have anecdotal evidence from some children suggesting that stretching is helpful, as well as theoretical evidence from the fatigue theory of growing pains to suggest that stretching would help in cases where children experience tightness in their limbs. The use of stretching exercises as an intervention strategy is discussed further in the general discussion.

The process model implies that children who experience unsuccessful results from actions that they take then code these actions as unsuccessful in managing pain and, therefore, might be less likely to use them in the future. This can be problematic because there is not necessarily a direct relationship between engaging in an action and experiencing pain relief. For example, a child might not experience relief from distraction because of the particular distraction technique she or he employed, or because distraction might not be sufficient for managing the level of pain she or he was experiencing at the time. This does not mean that distraction as a technique is not useful. We can influence how children make sense of their pain by assisting them in interpreting the outcome of their actions. One of the children in the study noted that stretching was

not helpful; however, this could be because she was stretching while in pain. It could be worthwhile to recommend in some cases that children stretch regularly while they are not in pain and monitor the effect on their growing pains.

Another implication of the process model is that when children feel that they have no control over the pain, part of their framework for pain could be made explicit to them. Specifically, their knowledge of what alleviates their pain could be reviewed by asking them for examples of what they have tried in the past and noting how successful these strategies were. New strategies could also be suggested and then reinforced through practice.

Encouraging self-management of pain is important for a number of reasons including that self-management of pain enables children to continue participating in daily activities (as described in the results section), and that developing self-management skills as a child perhaps facilitates coping with pain experiences as an adult.

### **5.8.2 Limitations**

The process model needs to be further explicated with regard to increased understanding of how children evaluate their pain experiences. It is particularly necessary to understand why children are reluctant to take medication at times for their growing pains and to determine under what circumstances children are more likely to use medication to manage their growing pains. Are they more likely to use medication when they have pain during the night? The model proposes that common societal beliefs about medication use and about tolerating pain likely explain why children do not take medication at times, despite stating that medication is helpful. This is supported by findings that mothers' transmission of information about medication influenced adolescents' transitions to independent pain management (Hatchette et al., 2006) and by

research indicating that children incorporate societal views when talking about the purpose of pain (Kortessluoma & Nikkonen, 2006). However, to further substantiate this component of the process model of growing pains, children with growing pains need to be interviewed specifically about their general beliefs about medication and about pain tolerance.

With regard to the outcome of actions, more information needs to be obtained regarding the circumstances under which children attempt actions that have been previously unsuccessful. Also, at what point in their development do children appreciate that there is not necessarily a direct relationship between performance of a pain management action and outcome? Factors such as intensity of pain and point in time at which the actions were carried out (i.e., as soon as the pain started versus later) could influence how successful the actions are.

In interviewing children about their pain management strategies I did not ask specifically whether they apply the same strategies to managing pain in the arms as they do in the legs. Children described an impact of growing pains on their sleep and on participation in activities; however, they were not asked if the impact is the same depending on the location of their pain.

The description of the sample is limited in that it was not determined whether children in the study have other recurrent pains. However, in depicting their pain on the body diagrams, a few children did indicate other areas of pain including stomach (1 child), neck (3 children), back (4 children), and chest (1 child). It is important to note though that children were specifically asked to indicate on the diagram areas where they have growing pains and so some children who might have experienced other recurrent

pains may not have indicated these. It is interesting to note that some children interpreted other pains as being growing pains.

The context in which the data were collected influences the type of data generated. In the focus group with young children (ages 5 to 7 years), children's expressions of increasingly dramatic metaphors such as "ten thousand elephants stepping on my leg" appeared to be socially reinforced. Growing pains tend to occur in the evening and during the night and are intermittent. It is possible that children's descriptions of their pain experiences were affected by recall bias. That is, they might only recall the most salient aspects of their experiences. It is possible that the association between physical activity and pain frequency could be a reflection of experiencing greater pain intensity after activity rather than increased frequency of pain. It is important to remember that the goal of this research was not to collect data such as the frequency of symptoms, or the number of times a child wakes in the night; these types of data can be influenced by recall bias. Even if children did not remember exact details, their stories reflected their experiences with pain.

### **5.8.3 Future Directions**

The process model implies that children engage in pain management strategies that they have found to be successful. However, the same strategy is not always successful. Rudolph, Dennig and Weisz (1995) suggested that use of variety of coping strategies could be explained by flexibility in response to failed strategies, ("if this strategy does not work, then I will try that one," p. 333) or by the ability to match coping responses to the situation ("if this strategy is not appropriate in this situation, then I will try that one," p. 335). An alternative explanation for use of a variety of strategies could be that individuals are unsuccessfully searching for a solution, thus demonstrating

ineffective coping (Worchel, Copeland, & Barker, 1987). A quantitative design could assess whether children with growing pains who have a variety of strategies to choose from have greater self-efficacy in their coping abilities and are more likely to attempt to self-manage their pain.

Interestingly, in making sense of their pain, the majority of children in this study attributed their pain to increased physical activity. Their observations are consistent with the fatigue model of growing pains and consistent with the results of an experimental study based on this theory and advocating stretching as a treatment (Baxter & Dulberg, 1988). An intervention study is necessary to determine whether in fact stretching is effective in managing growing pains and what types of stretches are warranted.

Children described difficulty with sleep (either falling asleep or waking from sleep) as the greatest consequence of growing pains. Additionally, a few parents in the study reported sleep disturbance as a result of being awakened by their children. Research needs to determine whether implementing pain management strategies before bedtime such as stretching and taking medication would be helpful and when these strategies are warranted.

## CHAPTER 6 INTEGRATION OF RESULTS FROM THE THREE PHASES OF THE RESEARCH

### 6.1 Introduction

Results from the three studies of this research program were integrated and together with the existing literature were used to develop a descriptive conceptual model of growing pains that describes predisposing factors, triggers, and alleviating factors. In addition, statements by physicians (Phase I), children (Phase III) and parents (Phases II & III) regarding interference with sleep and with activities, and regarding the pain location, time of occurrence of growing pains, and associated symptoms, provided a foundation to suggest questionnaire items that could be included in future studies of growing pains, once validated. The conceptual model and the questionnaire are presented in this chapter and limitations and applications of the model are discussed in chapter 7. In the past decade there has been a significant increase in the number of published research studies on growing pains; a search in Medline and PsycINFO in December 2008 using the search terms “growing pains” or “limb pain” and “children” or “pediatrics” revealed 11 experimental studies published between 2000 and 2008 compared to 3 studies published between 1990 and 1999. This new information on growing pains has not been presented in an integrated form and there has been no model proposed that can be used to guide further research. Although there has been an increase in empirical studies on growing pains, the studies are varied in their goals and there is not yet a strong empirical literature on growing pains. Therefore, it is important to note that the

component of the model describing predisposing factors for growing pains, which is based largely on existing literature, needs to be examined in future research. The strength in the model is that it is grounded in reports from children and parents regarding their experiences with growing pains and is also grounded in reports from physicians about their experiences with treating growing pains.

## **6.2 A Conceptual Model of Growing Pains**

The conceptual model of growing pains utilizes the following criteria for growing pains derived from the information obtained in the survey sent to physicians (Phase 1):

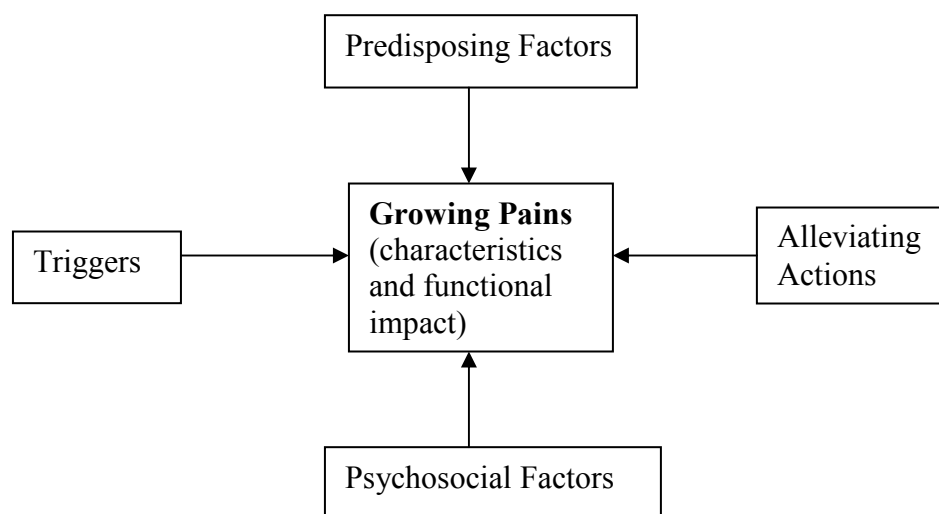
1) Recurrent and intermittent pain in the lower limbs occurring in the evening; 2) At least 3 episodes of pain within a 3 month period; 3) Bilateral pain; 4) No objective findings and no joint pain. Daytime pain and arm pain were not exclusionary criteria. It is important to note that there can be a distinction between clinical and research criteria (discussed further in chapter 7) and that the criteria presented here are those which are recommended for research studies.

The conceptual model (Figure 6.1) describes descriptive features of growing pains and the functional impact of growing pains (based on data from phases I and III), predisposing factors for growing pains (based on data from phase II and the existing literature), triggers for the pain (based on data from phases II and III), and factors that alleviate the pain (based on data from phases I and III). Additionally, the model acknowledges the influence of psychosocial factors on the subjective pain experience and on the extent to which growing pains affects functioning. A description of the model is provided below, along with comments on some of the relevant data from the various phases of the research. A summary of components of the model is presented in Figure 6.2.

### 6.2.1 Growing Pains

Growing pains can be characterized by the location of pain, the time of day when the pain occurs, and the intermittent nature of the pain. Growing pains is defined by intermittent nocturnal lower limb pain. Exclusion criteria include abnormal laboratory results and objective clinical findings. Some children experience daytime pain and some children experience arm pain. The pain typically occurs bilaterally, though some physicians reported that some children with growing pains experience unilateral pain. Results from the survey of physicians (phase I) and the literature largely support the criterion of non-articular pain, but some physicians do diagnose growing pains in children reporting joint pain. Children have used the following pain descriptors for growing pains: annoying, stiff, horrible, achy, sore, cramping, continuous, throbbing, squeezing and uncomfortable. Growing pains is not seen exclusively in children within a particular age range.

Figure 6.1 Conceptual Model of Growing Pains





Children typically do not experience a restriction in activity because of their growing pains, but they frequently experience difficulty falling asleep when they have the pain and some children experience being woken from sleep because of pain. Difficulty with sleep due to growing pains was described by both children and by parents who had growing pains as children. Some children report that they limit movement when they have growing pains at home. But, when children experience growing pains in the course of engaging in a physical activity they tend to continue their activity, although they might limit their exertion level. A few of the children who were interviewed reported not participating in physical activity at times because of their growing pains, indicating that some children are at risk for reduced participation in peer activities. Interestingly, children did not report that the pain impacted their ability to complete chores, but a few parents who had growing pains as children reported that the pain interfered with chores and one parent noted that the pain interfered with schoolwork. Children were not specifically asked about whether the pain interferes with chores or schoolwork.

### **6.2.2 Predisposing Factors**

Results from the risk factor study (phase II) suggested that illness or rash during the mother's pregnancy, maternal smoking during pregnancy, delayed standing (greater than 10 months), back pain in the family, and arthritis in the family, increase the odds of growing pains. It is possible that maternal illness during the pregnancy and maternal smoking could influence development of growing pains through intrauterine inflammation, resulting in pain hyper-responsiveness in later life. Delayed standing could be associated with decreased bone density (Friedland et al., 2005). Pain in the family could influence growing pains through genetic inheritance or social learning of displaying pain behaviour. Other predisposing factors might include orthopedic

abnormalities (Apley, 1976), and vitamin or mineral imbalances (Lech 2002). Although orthopedic abnormalities are included here under “predisposing factors” they could also be an etiological factor. Other than the association of orthopedic abnormalities with growing pains, the predisposing factors proposed here have limited evidence and need to be investigated further.

### **6.2.3 Triggers**

Physicians and children identified increased activity or strenuous activity as a trigger for the pain. Although children and some parents commented that physical activity appeared to cause their pain, it is not presented here as a predisposing factor as children with growing pains do not engage in more physical activity compared to healthy peers (Evans et al., 2006; Shrier et al., 2000).

### **6.2.4 Alleviating Actions**

Physicians and children reported the following effective ways of managing growing pains: heat, massage, and medication. Additionally, children reported stretching and use of distraction techniques as helpful.

### **6.2.5 Psychosocial Factors**

Psychosocial factors impacting on children’s experience with growing pains include the way of thinking about pain that is integrated from their interactions (both observational and direct communication) with parents, teachers, peers, and health care providers. There is a small body of literature associating growing pains with stress and anxiety, but these studies have not been conclusive (Naish & Apley, 1951; Oberklaid et al., 1997) and there have been no studies examining whether children with increased anxiety exhibit poor coping skills in managing their growing pains.

Table 6.2 Summary of Components of the Conceptual Model of Growing Pains

<b>Growing Pains: Characteristics</b>	<b>Predisposing Factors</b>	<b>Triggers</b>	<b>Alleviating Actions</b>	<b>Psychosocial Factors</b>
Intermittent	Maternal illness or rash during pregnancy	Physical activity	Heat	Social interactions influencing coping with pain
Lower limb or lower and upper limb	Maternal smoking during pregnancy		Massage with or without a topical ointment	
Evening or night time occurrence or evening/night time plus day time occurrence	Orthopedic abnormalities		Medication	
No objective signs	Decreased bone density		Stretching	
Typically bilateral	Genetic factors		Distraction	
	Vitamin or mineral deficiencies			
<b>Growing Pains: Functional Impact</b>				
Reduced Sleep				
Reduced participation in activities				

### 6.3 Questionnaires on Growing Pains

The only validated questionnaire for assessing growing pains is a parent questionnaire for children aged 4 to 6 years, developed by Evans and Scutter (2004a & 2004b). The definition of growing pains used by Evans and Scutter was: “intermittent,

bilateral leg pain that is non-articular in location and presents late in the day with normal physical and laboratory findings” (p. 42). The questionnaire was designed based on a review of the literature, interviews with parents, and a focus group with two children with growing pains. The questionnaire was administered twice within a period of three weeks and the average reliability of responses to 13 questions (eight of which had between 3 and 8 response options) was determined to be 82.4%, with reliability across the questions ranging from 45 - 100%. Items on the questionnaire included questions about the following: impact of pain (i.e. does the child wake from sleep, does the child cry, does the pain occur in both legs, does the pain occur at night); frequency of pain; health care professionals seen; what the parents have been told about the pain; treatments and investigations; is there a family history of growing pains; associations with sport, increased activity, growth, not wearing shoes, or flat feet; is there a reduced quality of life because of leg aches; demographic information on weight and height; activity level (ranging from “very active to “very inactive”). The questions asking about quality of life and activity level relied on parents’ subjective responses; the questions did not ask about how quality of life was affected and the kinds of activities that children participated in.

There is no validated questionnaire on growing pains for use with children. The questionnaire designed by Evans and Scutter (2004a & 2004b) was for the purpose of collecting epidemiological data and has limitations for use in studies of the impact of growing pains on children. Furthermore, this questionnaire was designed to assess leg pain and, therefore, is not suitable for assessing growing pains that occur in both the arms and legs. Additionally, there is currently no questionnaire specifically on growing pains that assesses the intensity and duration of the pain. Although the questionnaire designed

by Evans and Scutter asks parents whether their child's quality of life has been affected because of leg aches, the questionnaire does not ask what aspects of quality of life have been impacted. There is a general question about the experience of leg aches that includes an option of whether the child wakes from sleep. There is no assessment of whether the child has difficulty falling asleep because of the pain, or feels fatigued as a result of poor sleep. The questionnaire asks about the child's activity level, but does not ask about the kinds of activities the child engages in. It is recommended that future studies on the potential functional impact of growing pains on children include a more detailed assessment of the impact on sleep and activities. It is also recommended that studies inquiring about pain management of growing pains include an assessment of the perceived effectiveness of utilized pain management techniques.

### **6.3.1 Questionnaire Development**

The first step in developing a questionnaire on growing pains is to define the sample. In order to be specific about the sample that is used in a study, questions should be asked about the location of the child's pain and the time of day that the pain is experienced. If children in the study have not received a formal diagnosis of growing pains, it will be important to rule out the possibility of other conditions, by asking questions about the frequency of pain, laterality, and other symptoms.

The second step in developing the questionnaire would be to generate items. Item generation techniques include consulting the literature, holding focus groups, and/or consulting experts (Fishman & Galguera, 2003; Morgan, 1997). Utilizing these methods provides content validity for the measure (Fishman & Galguera, 2003). Any questionnaire on growing pains will need to be tailored to the research question asked in the study. For example, if the research question is about perceived effectiveness of

treatments, the questionnaire will need to not only ask about what treatments are used, but also about when they are used and how effective they are under particular circumstances. Therefore, the questionnaire items suggested in the next section are not comprehensive. They are based on current limitations in the literature. Specific limitations in current research on growing pains include poor descriptions of the sample and limited questions regarding the impact of growing pains.

Once the items have been generated they should be reviewed by a panel of experts (DeVellis, 1991). Each item could be rated on a scale from one to four based on the following features: relevance, clarity, simplicity, and ambiguity. For example, on rating relevance the following scaling could be used: 1= not relevant, 2 = item needs some revision, 3 = relevant but needs minor revision, 4 = very relevant (Yaghmaie, 2003). A Content Validity Index could be calculated for each item based on the proportion of experts that deem the item a 3 or a 4 (Yaghmaie, 2003). The items that are selected could be modified based on expert opinion.

The questionnaire should be pilot tested prior to a larger validation study to identify any problem areas. Respondents could be asked for feedback on the questionnaire to determine if they had difficulty answering any of the questions. Psychometric properties of validity and reliability should be determined. A factor analytic technique could be used to identify groups of items that covary together, indicating that they belong to the same content area. This analysis would ensure that the measure is multidimensional. The technique might reveal content areas which were not previously defined. Cronbach's alpha coefficient could be calculated for each content area to determine internal consistency (i.e. the degree of homeogeneity of the items

within a content area). Test-retest reliability could be determined by calculating the agreement between responses given at two different time points. If the questionnaire contains items to assess the child's quality of life or functional ability, these items could be correlated with responses on other established measures of quality of life or functional ability in order to determine convergent validity. After initial analysis of the questionnaire, it could be revised and re-administered to a new sample.

### **6.3.2 Questionnaire Items**

The following questionnaire items, in no particular order, are suggested for parents and could be adapted to be administered to children:

1) How often in the last 3 months has your child had an ache in the leg not due to an injury?

- ☐ Not at all
- ☐ Less than once a month
- ☐ Once a month
- ☐ More than once a month
- ☐ Once a week
- ☐ More than once a week
- ☐ Almost every day

This question and those that follow should also be asked for arm pain if the study is a prevalence study or if children with arm pain in addition to leg pain are included in the experimental study.

2) At what time of day does your child experience growing pains in the legs? (check all that apply)

- ☐ Morning
- ☐ Afternoon
- ☐ Evening
- ☐ During the Night

3) Where does your child's leg pain occur?

- ☐ Left leg
- ☐ Right leg
- ☐ Both legs

4) Does your child experience any of the following symptoms in his or her legs:

- ☐ Joint pain
- ☐ Swelling
- ☐ Redness
- ☐ Limping

If this question is used as a screening item, it will be important to follow up on reports of joint pain with none of the other symptoms indicated. Some parents indicate joint pain in the knee when in fact the pain is around the knee joint.

5) How often has your child experienced the following kinds of pain in the past 3 months?

a) Abdominal pain

- ☐ Not at all
- ☐ Less than once a month
- ☐ Once a month
- ☐ More than once a month
- ☐ Once a week
- ☐ More than once a week
- ☐ Almost every day

b) Headaches

- ☐ Not at all
- ☐ Less than once a month
- ☐ Once a month
- ☐ More than once a month
- ☐ Once a week
- ☐ More than once a week
- ☐ Almost every day



c) Back Pain

- ☐ Not at all
- ☐ Less than once a month
- ☐ Once a month
- ☐ More than once a month
- ☐ Once a week
- ☐ More than once a week
- ☐ Almost every day

d) Other: Please specify

- ☐ Not at all
- ☐ Less than once a month
- ☐ Once a month
- ☐ More than once a month
- ☐ Once a week
- ☐ More than once a week
- ☐ Almost every day

### **6.3.3 Determining the Impact of Growing Pains on Functioning**

Both parents and children reported that growing pains interferes with sleep.

The following questions are recommended to gather basic information about sleep interference.

1) How often does your child have difficulty falling asleep when he or she has growing pains in his or her legs at night?

- ☐ Never
- ☐ Sometimes
- ☐ Every time

2) How often does your child wake up in the night because of growing pains in the legs?

- ☐ Never
- ☐ Sometimes
- ☐ Every time

3) In the past 3 months how often has your child been tired at school because of sleep interference due to growing pains?

- ☐ Not at all
- ☐ Less than once a month
- ☐ Once a month
- ☐ More than once a month
- ☐ Once a week
- ☐ More than once a week

The following questions are suggested in order to develop information about the impact of growing pains on daily activities.

4a) Does the growing pains in your child's legs interfere with their ability in performing any of the following activities and if so how often:

- |                                     |       |           |       |
|-------------------------------------|-------|-----------|-------|
| <input type="checkbox"/> Sports     | Never | Sometimes |       |
| Every time                          |       |           |       |
| <input type="checkbox"/> Chores     | Never | Sometimes |       |
| Every time                          |       |           |       |
| <input type="checkbox"/> Homework   | Never | Sometimes | Every |
| time                                |       |           |       |
| <input type="checkbox"/> Class work | Never | Sometimes | Every |
| time                                |       |           |       |
| <input type="checkbox"/> Gym class  | Never | Sometimes | Every |
| time                                |       |           |       |

4b) Please specify for each relevant activity how the child's ability is affected (e.g. child does not do the activity, child does not run as much when playing sports)

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5) How many hours of physical activity does your child engage in per week (e.g. sports, chores such as shoveling, gym class).

- ☐ None
- ☐ 1 to 5 hours
- ☐ 5 to 10 hours
- ☐ 10 to 15 hours
- ☐ 15 to 20 hours
- ☐ More than 20 hours

## **6.4 Conclusion**

It is hoped that the conceptual model will provide a guide for areas of future research on growing pains. Limitations and applications of the model are discussed in the next chapter. There is a need for more systematic research on growing pains and utilization of validated questionnaires will facilitate insight into the functional impact of growing pains as well as perceived efficacy of treatments. Interestingly, among prevalence studies, the highest prevalence (36%) was found in children aged 4 to 6 years whose parents were given a validated questionnaire. Given the variability in how growing pains has been defined in prevalence studies to date, it is likely that a validated questionnaire will provide a more accurate estimate of prevalence in older children.

## CHAPTER 7

### GENERAL DISCUSSION

The primary aim of this program of research was to develop a conceptual model of growing pains that defined the condition and described associated features. In addition to this conceptual model, a process model was developed that describes children's experiences with growing pains. The body of research on growing pains has utilized varied definitions of the condition, rendering it difficult to compare results of studies. Therefore, it was imperative to develop a definition of the condition based on how growing pains is currently being defined and diagnosed by physicians. In phase I of the research, physicians were surveyed regarding their definitions and diagnostic criteria for growing pains. In phase II of the research, risk factors for growing pains were explored using bivariate statistics and logistic regression modeling. In phase III of the research, children were interviewed about their experiences with growing pains and parents completed a questionnaire about their own and their child's experiences with growing pains. Grounded theory methods were used to develop a process model of children's experiences with growing pains. In phase IV of the research, information from the survey of physicians, the risk factor study, child interviews, and parent questionnaires about growing pains, were used to develop a conceptual model and to propose items for questionnaires on growing pains. In this general discussion, the results from this program of research are discussed in relation to previous research on growing pains. The limitations of each study have been discussed previously and, therefore, only major

limitations will be highlighted here. Finally, implications for assessment and treatment and suggestions for future research, based on the integrated results, will be discussed.

### **7.1 Definition and Diagnostic Criteria**

Growing pains has been defined in various ways. Some authors propose that growing pains occurs exclusively in the lower limbs (Abu-Arafeh & Russell, 1996; Peterson, 1986), whereas others propose that the condition can occur in the arms or legs (Oberklaid et al, 1997). Some reports state that growing pains occurs exclusively in the evening or during the night (Manners, 1999; Peterson, 1986), whereas others allow for daytime symptoms (Abu-Arafeh & Russell, 1996). The survey of physician's definitions and diagnostic criteria indicated the following diagnostic criteria for growing pains:

- 1) Pain in the lower limbs
- 2) Nocturnal pain
- 3) No abnormal objective findings (i.e. no clinical abnormalities such as swelling, tenderness, bruising or redness, or limited movement)
- 4) Pain is intermittent

The criterion of three episodes of pain within a three-month period, used in phase III, is arbitrary, though based on Apley's criteria for recurrent abdominal pain (1975), and is not intended for clinical use. This criterion was applied in phase III along with the other criteria to ensure that the children recruited had growing pains. However, in the screening interview, parents were also asked about the general pattern of their child's pain. Children with growing pains might for example, have 2 episodes of pain within 3 months and then a month later have a number of pain episodes. Also, there may be a few months when the child does not experience pain, but then experiences a bout of episodes. Although all of the children in the current study met the criteria of 3 episodes of pain in

the previous 3 months at the time they were screened, one parent reported that her child could have no pain episodes for a 2-to-3 month period; this does not mean, then, that the child does not have growing pains.

An age criterion should not be used in making a diagnosis of growing pains in children or adolescents. The survey results showed that physicians saw children with growing pains ranging in age from 2 to 15 years and this does not exclude the possibility that younger infants, older adolescents, and possibly adults, experience growing pains. In fact, two physicians commented that growing pains can occur in adults and one of the parents in phase III of the research described having growing pains as an adult.

If uniform diagnostic criteria are to be adopted by medical professionals, consensus will need to be reached on whether joint pain and unilateral pain are features in some cases and, thus, not exclusionary criteria. The results from the risk factor study (phase II) indicated that some parents describe their children with growing pains as having joint pain, but it could very well be the case that the parents are describing pain in the region of joints rather than actual joint pain. For example, it is common for children with growing pains to experience pain in the popliteal fossa<sup>1</sup>, but they may describe this pain as knee pain. With regard to laterality, it would be unusual for a child with growing pains to have unilateral pain. If unilateral pain is not to be considered an exclusionary criterion, then it would be important to ensure that the child with unilateral pain undergoes medical assessment to rule out any other potential rheumatic or injury-related conditions. For research samples it is recommended that children with joint pain and unilateral pain be excluded as it might be possible that they have another musculoskeletal

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<sup>1</sup> Popliteal fossa is the hollow space at the back of the knee joint

condition or rheumatic disease. If children with these features are included, this should be noted in the description of the sample and they should ideally have undergone a clinical evaluation to confirm the diagnosis of growing pains.

Given that there is limited support for any etiological theories, it is recommended that definitions of growing pains not include reference to a known etiology. Given that both physicians and children in this research noted symptoms of arm pain and daytime pain, it is recommended that a definition of growing pains not exclude this possibility. The following definition is recommended: Growing pains is intermittent pain of unknown etiology, typically occurring nocturnally in both lower limbs. Daytime pain and arm pain should not be exclusionary criteria.

#### **7.1.1 Terminology**

At the outset of this research it was hoped that an alternative term to growing pains would be recommended based on responses obtained in the survey of physicians. Although physicians suggested various alternative terms, and although alternative terms have been suggested and used in the literature (Abu-Arafah & Russell, 1996; Al-Khattat & Campbell, 2000; Lech, 2002), it is recommended that the term growing pains continue to be used for several reasons. First, any term suggested that would adequately describe the condition was not user-friendly. A long, clinical sounding term like “benign idiopathic nocturnal limb pains of childhood,” would likely not be used by parents and children who are accustomed to the simplicity of the term “growing pains.” Any term that is to replace growing pains needs to be one that would be widely acceptable for use by physicians and the general public. Secondly, although the term growing pains is misleading, it is clear that the term refers to a condition that is distinct from other limb

pains. Terms such as “recurrent limb pains” do not rule out the possibility of limb pains other than growing pains.

## **7.2 Subgroups of Growing Pains**

Potential subgroups of growing pains cited in the literature are based on informal/clinical observations rather than empirical evidence. Naish and Apley (1951) reported that their study sample fell into three groupings: 1) “Ill-defined pains,” characterized by diurnal and nocturnal limb and body pain; 2) “Diurnal fatigue pains,” characterized by children who had predominantly diurnal pain, particularly after increased activity; and 3) “Paroxysmal nocturnal pains”, characterized by children whose pain was predominantly nocturnal. Sheldon (1951) described growing pains as falling into two categories – growing pains related to atmospheric changes and growing pains related to fatigue. Craft (1999) proposed that the diagnosis of growing pains fit into one of the following groupings: night cramps, hypermobile joints, or psychosomatic pains. Recently, Lowe and Hashkes (2008) suggested that some children with growing pains present with a fibromyalgia variant.

The survey of physicians (Phase I) indicated that the majority of physicians (77%) did not consider there to be subgroups of growing pains. However, a small percentage (11%) did consider there to be subgroups. The possible different groups included: children who have recurrences depending on activity level versus those who do not, children who have pain in the arms versus the legs, children who have pain in the daytime versus nocturnal pain, children who have sleep difficulties and are over-tired, children whose pain is reinforced by a parent with chronic pain, and children who have a low pain threshold. Data from the child interviews and parent questionnaires (phase III) support the report that some children with growing pains experience pain after increased



activity and that some children experience sleep difficulties due to their pain. However, future studies would need to determine whether or not these symptoms are widespread amongst children with growing pains.

It is worthwhile to ask the following question about creating subgroups: what would be the utility of grouping children? The answer is dependent on how the children are grouped. Simply creating subgroups based on features of the condition (e.g. nocturnal pain versus nocturnal and daytime pain) is perhaps not useful unless the groups indicate a different etiology or pathogenic process, or unless specific interventions are warranted depending on grouping. For example, it might be worthwhile to group children with growing pains dependent on whether or not they have postural abnormalities. Those children with orthopedic abnormalities might benefit from orthopedic or physiotherapeutic interventions. In a single case design intervention study with eight participants, Evans (2003) demonstrated the benefit of shoe inserts for children with growing pains who had a pronated foot posture.

### **7.3 Etiology & Risk Factors**

The etiology of growing pains is unknown. Four theories of causation have been described in the literature: growth of the bone or soft tissue, fatigue, psychosocial problems, and orthopedic abnormalities. It is possible that there is not a single factor that explains why some children develop growing pains and others do not. Rather, it is likely that multiple factors, including genetic vulnerability, contribute to the development of growing pains. In Phases III, data pointed to aggregation of growing pains in families and in Phase II, data indicated greater odds of pain problems in families of children with growing pains as compared to children without growing pains.

Data from this study indicate that the fatigue theory of growing pains would be worth investigating empirically. Physicians, children, and parents, described an association between increased physical activity and growing pains. It might not be the case that increased activity or fatigue in the limbs actually causes growing pains. Growing pains appears to be exacerbated, at least in some cases, by increased activity. It could be the case that certain activities performed in the absence of stretching increase muscle tightness, thereby contributing to inefficient elimination of waste products such as lactic acid, and hence, increasing fatigue and pain responsiveness. Children's ligaments and muscle tendons are in the process of elongating in response to bone growth (O'Neill & Micheli, 1988) and, therefore, they might be more vulnerable to pain as a result of muscle tightness. Children might be more likely to remember episodes of growing pains after they have participated in extracurricular activities because they might experience greater pain intensity at these times. Evans, Scutter, Lang, and Dansie (2006) found no difference in parents' estimated ratings of activity level among children with growing pains compared to healthy children. The authors did not describe how activity level was defined and it is possible that it is the type of activity rather than duration that precipitates growing pains.

In phase III, a few of the mothers who had growing pains as children commented that they had experienced similar pain to growing pains when they were pregnant. Cramps during pregnancy are common, but growing pains is qualitatively different to cramps. It could be the case that these parents experienced muscle tightness and reduced flexibility during their pregnancies and/or overtiredness due to weight

bearing, both of which could be similar to pain due to overtiredness and tight muscles in growing pains.

Clinical observational reports have suggested associations between growing pains and the following factors: family history of the condition (Apley, 1976), damp living conditions or cold environmental conditions (Apley 1976; Naish & Apley, 1951). Family history of the condition has also been reported in a prevalence study (Evans & Scutter, 2004a). Empirical studies have found associations between growing pains and the following factors: increased bone speed of sound - indicative of decreased bone density (Friedland et al., 2005), lower pain thresholds, (Hashkes et al., 2004) and imbalances of lead and magnesium levels (Lech, 2002). There have been no longitudinal case control studies examining risk factors for growing pains.

In the current risk factor study (phase II), sign test comparisons and odds ratio comparisons between children with growing pains and control children found that growing pains was associated with maternal rash or illness during the pregnancy, fatigue, joint pain, joint swelling, abdominal problems, muscle pain or weakness, and having family members with pain problems, muscle disease or arthritis. Comparisons between children with growing pains and children with JIA indicated that growing pains was associated with illness or rash during the mother's pregnancy, ear problems, muscular pain or weakness, and having family members with symptoms of pain, birth defects, or a nervous breakdown.

The results indicate that children with growing pains can be distinguished from children with JIA on the basis of no joint swelling or joint pain. It was expected that children with growing pains would be more likely to experience abdominal pains

compared to the control children, as previous studies have found associations between having recurrent abdominal pain and limb pains (Perquin, et al., 2000; Ramchandani, Hotopf, Sandhu, Stein, & the ALSPEAC Study Team, 2005; van Dijk et al., 2006). Sleep interference could explain why children with growing pains might have been more likely to experience fatigue compared to control children. The finding that children with growing pains were more likely to have a family member with pain problems compared to control children is consistent with studies that have found a familial aggregation of pain symptoms (Grøholt, Stigum, Nordhagen, & Köhler, 2003; Laurell, Larsson, & Eeg-Oloffson, 2005). It should be noted that the comparison between children with growing pains and children with JIA on having a family member with pain showed a confidence interval for the odds ratio that included the possibility of no association. Furthermore, the confidence interval for the comparison of growing pains and control children on having a family member with a pain problem had a very wide interval, implying poor precision. The following findings do not have theoretical support: children with growing pains were more likely to experience ear problems compared to children with JIA, children with growing pains were more likely to have family members who had experienced a nervous breakdown or had a birth defect compared to children with JIA, children with JIA had more children living in the home compared to children with growing pains. These results need to be interpreted tentatively as the analyses were exploratory. Potential explanations for the sign test and odds ratio results were discussed in more detail in Chapter 4. The finding of increased likelihood of illness or rash during pregnancy among children with growing pains was also found in logistic regression modeling and is discussed below.

Maternal illness or rash during pregnancy, maternal smoking during pregnancy, age at standing greater than 10 months, low back pain among relatives, and arthritis among relatives were predictors of growing pains in logistic regression modeling ( $p < .001$ ). Illness or rash during pregnancy and smoking could affect nociceptive processing in the developing fetus and, thereby, increase the risk of developing growing pains. Pain in relatives could be associated with growing pains because of a shared genetic predisposition to pain syndromes and/or because of the impact of social learning in pain expression. It could be the case that parents who had family members with pain problems were more likely to take their children to see a physician regarding their child's pain symptoms. Standing at greater than 10 months might be indicative of decreased bone density.

Along with illness or rash during pregnancy, smoking, delayed standing, and family history of pain problems (back pain and arthritis), additional predisposing factors which were described in the conceptual model of growing pains included orthopedic abnormalities (Apley, 1976), decreased bone density (Friedland et al., 2005), genetic factors, and vitamin or mineral imbalances (Lech 2002).

#### **7.4 Impact**

The impact of growing pains has not been well studied. Prevalence studies have indicated that growing pains interferes with sleep (Evans et al., 2006; Oberklaid, 1997; Seham & Hilbert 1933) and with activity (Abu-Arafeh & Russell, 1996), but studies have not been conducted to examine the extent to which pain interferes with activity nor the type of activity. Also, studies have not been conducted to examine the extent to which sleep is interrupted and the impact of sleep interruption among children with growing pains. Studies on the impact of acute sleep deprivation in children indicate

that cognitive functioning (verbal creativity and abstract thinking) is decreased after a single night of restricted sleep (Randazzo, Muehlbach, Schweitzer & Walsh, 1998) and that decreased sleep impacts classroom academic performance (Fallone, Acebo, Seifer, & Carskadon, 2005). In phase III of the research, children and parents described growing pains as impacting onset of sleep and sleep interruption. Children also noted that growing pains interfered with performance during physical activity, but for most children the pain seldom interfered with participation in physical activity. Parents reported that their own growing pains had interfered with chores and schoolwork.

The process model of growing pains developed in phase 3 indicates that the impact of growing pains is influenced by the strategies children engage in to manage their pain, which are influenced by how they evaluate and make sense of their pain.

### **7.5 Interventions**

Common interventions recommended for growing pains include heat, massage, and non-opioid analgesics. Results from the physician survey (phase 1) were consistent with these recommendations. It is surprising that distraction was only mentioned once in the literature (Doughty, 1988) as a possible intervention strategy and that, until recently, there has been no mention of cognitive behavioural therapy as a potential intervention in certain cases (Uziel & Hashkes, 2007). Cognitive behavioural therapy is commonly used to treat other kinds of recurrent pains (Eccleston, Yorke, Morley, Williams, & Mastroiannopoulou, 2003). In phase III children reported finding distraction helpful in managing their pain and a few parents commented on facilitating the use of distraction as a coping technique. It is also surprising that stretching as an intervention study has not been studied further since Baxter and Dulberg's (1988) experimental study indicating that

stretching could be a promising intervention. Some of the children in phase III reported finding stretching helpful as a pain management technique.

The process model of growing pains developed in phase III indicated that children developed a framework for how to understand and cope with their pain based on their experiences and their interactions with others. Their individual frameworks have implications for how they might manage coping with other types of pain experiences and how they might manage pain as adults. In order to facilitate children in self-managing their pain, interventions need to target children's interactions with their social environment as well as how they evaluate and make sense of the outcome of unsuccessful attempts at pain management. Specific examples were presented in Chapter 5.

## **7.6 Limitations**

Limitations of phases I to III of the study were previously discussed. In this section only the major limitations of each phase will be highlighted as these have implications for the use of the conceptual model developed in phase IV. First, with regard to phase I, responses obtained from physicians were based on open-ended questions and, therefore, the use of frequency counts in interpreting the results is only useful for providing a sense of the range of responses and should not be used as an indicator of responses in the general population of physicians. The strength of using open-ended questions is that a full range of responses were obtained and these data could be used to develop closed-ended questions for a future survey. A further limitation of these data is that the physicians were not asked about their comfort level in diagnosing growing pains nor asked about their confidence in the diagnostic criteria they use. It would be important to link comfort level with diagnosing growing pains and with use of diagnostic criteria to qualitative information on actual criteria used for diagnosis,

especially if these data were to be included in an argument for or against the use of laterality and joint pain as diagnostic criteria.

Secondly, with regard to phase II, determining risk factors for growing pains, data were collected based on parent report and it is possible that parents made errors in their reporting of past events. The study was limited in that it was exploratory and, therefore, numerous analyses were conducted which were not guided by hypotheses. An alpha level below .05 was not used to control for the number of analyses run, as the study was exploratory. Statistical corrections made when many variables are tested simultaneously within an analysis were not applicable. A further limitation with the nonparametric testing used is that the sign test is not very sensitive to detecting significant differences; the freedom from assumptions about the sample come at the cost of power (Howell, 2002). Logistic regression is a more powerful statistical technique for detecting associations between an outcome or dependent variable and predictor variables. It is important to remember though that causal inferences cannot be made from the analysis. Our understanding of the variables that were significant in the logistic regression modeling is limited by the nature of the questions asked when these data were collected. We do not know the type of illness or rash that mothers had nor do we know how much they smoked. We do not know the ages at which children in the sample achieved the milestone of standing. Finally, we do not know how the family members with back pain and/or arthritis were related to the children in the sample. These results do, however, provide direction for variables to examine in future longitudinal studies.

Third, with regard to phase III, the sampling method did not firmly adhere to grounded theory sampling, in the sense that specific types of participants were not



recruited based on the analysis. However, the criteria for sample selection were carefully determined based on results from phase 1 and the sample was representative of the range of presentations of growing pains. These data did not indicate differences in pain experiences between children who experienced daytime pain versus those who did not and those who experienced arm pain versus those who did not and, therefore, further sampling of certain “populations” within growing pains was not conducted. However, it is important to note that the children were not specifically asked about differences in their approaches to daytime and arm pain versus night time pain and leg pain.

Aspects of the conceptual model developed in phase IV of this research study are based on exploratory research (phase II). However, the model was not designed as one to be tested empirically as a whole, but rather the purpose of the model is to guide further research in the areas of predisposing factors, functional impact, and intervention. There might be differences among children who experience daytime and/or arm pain versus those who do not and the model does not provide specific indication as to what differences to consider. With regard to the influence of anxiety on growing pains, there is insufficient evidence to support an association and, therefore, anxiety was not included under psychosocial factors in the conceptual model. Some studies have found an association between anxiety and recurrent abdominal pain (Garber, Zeman, & Walker, 1990; Scharff, 1997), whereas others have not (Kaufman et al, 1997). It would be a leap to suggest that children with growing pains might have increased anxiety based on the recurrent abdominal pain literature as the impact of the pain between the groups is different; some children with nonorganic recurrent abdominal pain undergo excessive diagnostic testing and miss a significant amount of school, which impacts peer

relationships (Kaufman et al.,1997). Catastrophizing has been associated with increased pain severity among children with chronic pain (Schanberg, Keefe, Lefebvre, Kredich, & Gil, 1996; Vervoot, Goubert, Eccleston, Bijttebier, & Crombez, 2006), but was not included in the model as pain catastrophizing in children with growing pains has not been examined. It is possible that children with growing pains who have a tendency to catastrophize might experience poorer ability in self-managing their pain. The model does not indicate whether a subset of children with growing pains are at risk for developing other pain conditions in adulthood. We do not know if children with growing pains are at risk for developing conditions such as fibromyalgia or restless leg syndrome in adulthood.

### **7.7 Clinical Implications and Suggestions for Research**

Throughout the document suggestions have been made for future research. This section will provide some specific directions with regard to clinical assessment and intervention. With regard to diagnosis of growing pains, it was surprising that there were a few physicians in the survey who indicated joint pain and unilateral pain were not exclusionary criteria for growing pains. Consensus needs to be reached in the medical community as to whether some children with growing pains have joint pain and unilateral pain. A future survey could provide a list of diagnostic inclusion and exclusion criteria, and features of growing pains, rather than asking open-ended questions. As mentioned above, children presenting with daytime pain in addition to night pain should not be automatically excluded as not having growing pains. The same applies to children presenting with arm pain in addition to limb pain. An age range should not be considered as diagnostic criteria, though age might be factored in when determining whether laboratory tests are warranted.

Distraction has only been mentioned once in the literature on growing pains and is not typically included in recommendations for treatment of growing pains. Children and parents indicated that distraction techniques are helpful. Future studies could look at whether visual imagery is beneficial in attempting to manage the pain at night. Strategies for managing growing pains should be tested empirically, but in the interim, distraction in the form of engaging in a preferred activity or thinking about a pleasant experience could be included with other pain management suggestions. As always, the intervention used needs to be appropriate for the specific child and the situation. One of the parents in this study quite appropriately stated that she did not want her child to engage in distraction with music or reading during the night.

It is surprising that Baxter and Dulberg's (1988) stretching intervention study has not been replicated. Three possible reasons are proposed for the paucity of intervention studies. First, there has not been uniformity in defining growing pains deeming sample selection difficult. Secondly, etiology for the condition is unknown making it difficult perhaps to determine which interventions to target. Third, growing pains is intermittent, and, therefore, a reduction in the frequency of growing pains could be interpreted as a result of the intermittent pattern of the pain, rather than due to the intervention. Results from the current study indicate that many children attribute their growing pains to increased activity. It is possible that children with growing pains experience tight muscles and would benefit from stretching either regularly or prior to sports. Stretching as an intervention would be consistent with children's theories about their pain. It would be interesting to examine if children are more likely to engage in an intervention that is consistent with how they make sense of their pain. Any stretching

study would need to implement specific stretches targeted to the locations in which growing pains occurs. The control sample would be a challenge in such a study as it would be unethical for the control sample not to engage in interventions they ordinarily use. Any interventions, including distraction, would need to be carefully documented. Considering that accepting the null hypothesis would not indicate that stretching is an ineffective intervention (it could be just as effective as taking medication for example), it would be worthwhile to conduct a study utilizing a within-subject single-case experimental design to determine if children with growing pains experience a reduction in the frequency and intensity of their growing pains while engaging in a stretching program.

## **7.8 Conclusion**

At the outset of planning this research program I had hoped to conduct a treatment study. I quickly realized that very little was actually known about growing pains, and that various definitions and diagnostic criteria were in use. It was disconcerting to read reports in medical practice journals where growing pains was inconsistently defined. Lack of a universal definition is problematic for both research and clinical diagnosis. It is imperative that in publication of research on growing pains authors clearly state the criteria they used for inclusion and exclusion. Definitions of growing pains through history have been constructed based on clinical observation, personal opinion, and popular opinions of the time regarding rheumatic conditions in children. It is unfortunate that in the late 20<sup>th</sup> century there was very little research on growing pains. Observations by physicians, parents, and children in this research noting that growing pains is associated with increased duration of activity or intensity of activity are consistent with the fatigue theory of growing pains proposed by Bennie in 1894.

The current research has demonstrated the utility of a mixed method approach to developing a conceptual model of children's pain experiences. The children who participated in this study have shown us that they develop their own theories about their pain based on their intra-personal and inter-personal experiences and they have reminded us to include their stories in our understanding of their experiences.

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APPENDIX A  
ETHICAL APPROVAL FOR STUDIES CONDUCTED IN PHASES I AND II



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Department of Psychology

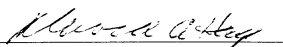
**BSC#:** 03-1280

**DATE:** November 24, 2003

The University of Saskatchewan Behavioural Research Ethics Board has reviewed the Application for Ethics Approval for your study "Background Study on the Definition and Classification of Idiopathic Limb Pain in Children and Adolescents" (03-1280).

1. Your study has been APPROVED.
2. Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Committee consideration in advance of its implementation.
3. The term of this approval is for 5 years.
4. This approval is valid for five years on the condition that a status report form is submitted annually to the Chair of the Committee. This certificate will automatically be invalidated if a status report form is not received within one month of the anniversary date. Please refer to the website for further instructions: <http://www.usask.ca/research/behavrsc.shtml>

I wish you a successful and informative study.

  
Dr. David Hay, Acting Chair  
University of Saskatchewan  
Behavioural Research Ethics Board

DH/ck

**Office of Research Services, University of Saskatchewan**  
Room 1607, 110 Gymnasium Place, Box 5000 RPO University, Saskatoon SK S7N 4J8 CANADA  
Telephone: (306) 966-8576 Facsimile: (306) 966-8597  
<http://www.usask.ca/research>

APPENDIX B  
LETTER TO PHYSICIANS REGARDING DEFINITIONS OF GROWING PAINS



**Research Group on Pain in Childhood**

Department of Psychology, University of Saskatchewan, Saskatoon, SK S7N 5

Phone: (306) 966-2039 - Fax (306) 966-6630

E-mail: [painlab@sask.usask.ca](mailto:painlab@sask.usask.ca)    [sask.usask.ca/~forsyths/painlab](http://sask.usask.ca/~forsyths/painlab)



Dr. Name  
Address  
IDN

Date

**Re: Definitions of Growing Pains**

Dear Dr. Name

I am writing to ask for a few minutes of your time to help in a study being conducted as part of a doctoral dissertation on "growing pains." This project is intended to help understand what growing pains are and what can be done to help children with these pains.

A limited number of physicians across Canada are being asked to answer a brief questionnaire on definitions of growing pains. Your input is important for the following reasons:

- Growing pains are a common problem, but there is no common definition
- To provide the best treatment recommendations we need to know how to distinguish growing pains from other limb pains
- It is important to examine whether there are subgroups of children with growing pains

The information from this research will be used to develop a validated measure for use in studies examining daily functioning, sleep, and predictors of coping among children with growing pains.

This project has received ethical approval from the University of Saskatchewan Behavioural Research Ethics Board (BSC#: 03-1280). Your answers are completely confidential. The purpose of the identification number on the questionnaire is so that your name can be removed from the mailing list. Information will be securely stored in the Pain in Childhood laboratory for five years. It is expected that the results of this research will be reported in a summarized form at conference presentations. If you are interested in seeing the results, a short report providing feedback on the study will be posted by August, 2004, on the website shown above.

I would appreciate it if you would fill out the enclosed one page questionnaire and return it in the postage-paid envelope, or, if you prefer, complete the questionnaire online at <http://tinyurl.com/326of>

Please do not hesitate to contact me regarding any questions or comments you might have. You may contact the Office of Research Services at 306-966-2084, if you have any questions about your rights as a participant.

Thanks for your anticipated contribution to this study!

Sincerely,

Faizah Visram, Doctoral Candidate in Clinical Psychology

Advisory Committee:  
Carl von Baeyer (Supervisor), PhD, RD Psych  
Tammy Marche, PhD Psych  
Margaret McKim, PhD, RD Psych  
Alan Rosenberg, MD, FRCPC

APPENDIX C  
SURVEY POSTCARD

Faizah Visram  
Research Group on Pain in Childhood  
Department of Psychology  
University of Saskatchewan – 9 Campus Drive  
Saskatoon, SK S7N 5A5



25 June 2004

Last week a survey about growing pains was mailed to you.

If you have completed the survey please accept my sincere thanks. If not, I would be grateful if you could please do so. You can complete it online at <http://tinyurl.com/326of> or mail the copy you were sent in the stamped return envelope. If you did not receive the survey please contact me and I will mail it out to you today.

Your help with this project is appreciated.

Faizah Visram  
Doctoral Candidate in Clinical Psychology  
Phone (306) 966 – 2039 Fax (306) 966 6630  
[painlab@sask.usask.ca](mailto:painlab@sask.usask.ca)

APPENDIX D  
SURVEY ON GROWING PAINS



**Research Group on Pain in Childhood**

Department of Psychology, University of Saskatchewan, Saskatoon, SK S7N 5A5

Phone: (306) 966-2039 - Fax (306) 966-6630

E-mail: [painlab@sask.usask.ca](mailto:painlab@sask.usask.ca)     [sask.usask.ca/~forsyths/painlab](http://sask.usask.ca/~forsyths/painlab)



<b>Growing Pains Questionnaire</b>	
Do you use the term growing pains?	<input type="radio"/> Yes <input type="radio"/> No
Is the term growing pains an appropriate label for the condition?	<input type="radio"/> Yes <input type="radio"/> No Why or why not?
How do you define growing pains? Are there diagnostic criteria and do these include an age range? If so, please specify.	
Do you use a term other than growing pains (e.g., recurrent limb pain) to describe this condition?	<input type="radio"/> Yes <input type="radio"/> No If yes, what term?
Do you consider there to be subgroups of growing pains (e.g., arm pain versus leg pain; nocturnal versus daytime pain)?	<input type="radio"/> Yes <input type="radio"/> No If yes, please indicate the subgroups

APPENDIX D (continued)  
SURVEY ON GROWING PAINS

If you use a term other than growing pains, does it apply to other conditions?	<input type="radio"/> Yes <input type="radio"/> No If yes, what other diagnoses does it include?
What is your medical specialty or discipline?	
How many years have you been in medical practice?	

Please use the back of the page to add any other comments you may have on growing pains and return in the postage-paid envelope.

**Thanks for your time!**

## APPENDIX E

### TELEPHONE INTERVIEW TO DETERMINE STUDY ELIGIBILITY

### Telephone Interview for “Growing Pains: The Child’s Perspective”

Child Name: \_\_\_\_\_ Age: \_\_\_\_\_ Gender: \_\_\_\_\_

Parents:

Telephone:

Email:

Diagnostic information:

Does your child always have pain in the same leg or in alternate legs?

At what time of day does your child usually have pain?

In the past 3 months how many times has your child had pain?

Does your child have any joint pain, swelling or tenderness?

Other information:

Times available:

Consent to videotape:



APPENDIX F  
RECRUITMENT POSTER



# Does your child have leg pains at night?

We want to talk with children who have "growing pains" to find out about their experiences so we can help physicians better understand what growing pains are and how children can be helped.

Boys & girls age 6 to 12 are invited to talk in groups with the researcher and other children their age about their experiences.

The groups will be about an hour and will be held at the University of Saskatchewan. Call Ms. Faizah Visram at the Child Health Research Group (966-1349) to find out more.

Parents will be given a \$5.00 honorarium towards parking and travel costs.

This project is part of a doctoral dissertation in psychology and has received ethics approval from the University of Saskatchewan Behavioural Research Ethics Board on March 6/06



Visit our website at <http://www.usask.ca/childpain>

Child Health Research Faizah Visram 966-1349	Child Health Research Faizah Visram 966-1349	Child Health Research Faizah Visram 966-1349	Child Health Research Faizah Visram 966-1349	Child Health Research Faizah Visram 966-1349	Child Health Research Faizah Visram 966-1349	Child Health Research Faizah Visram 966-1349
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APPENDIX G  
COVER LETTER TO CLINICS



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**Child Health Research Group**

Department of Psychology, University of Saskatchewan,  
Saskatoon, SK S7N 5A5

Phone: (306) 966-2039 - Fax (306) 966-6630

E-mail: [faizah.visram@usask.ca](mailto:faizah.visram@usask.ca)

[www.usask.ca/childpain](http://www.usask.ca/childpain)

---

April 27, 2007

[Name of Clinic]

[Address]

Dear Sir or Madam,

We would be grateful if you would consider posting the enclosed research notice at your clinic. It is an invitation to participate in a study on so called "Growing Pains".

This study involves interviewing children (aged 6 to 12) in groups or individually about their experiences with leg aches. The notice invites parents to call to find out more about this project if their children are interested in participating. This research has received ethical approval from the University of Saskatchewan Behavioural Research Ethics Board (Beh #06-36).

If you have further questions about the notice or the research project please contact Faizah Visram at 966-2039 or by email at [faizah.visram@usask.ca](mailto:faizah.visram@usask.ca)

Thank you for considering this request.

Sincerely,

Handwritten signature of Faizah Visram in black ink.

Faizah Visram  
Doctoral Candidate in Clinical Psychology  
University of Saskatchewan

Handwritten signature of Carl von Baeyer in black ink.

Supervisor: Carl von Baeyer, PhD,  
RDPsych  
Professor of Psychology &  
Associate Member in Pediatrics

APPENDIX H  
ADVERTISEMENTS FOR STUDY ON GROWING PAINS

**Study on Growing Pains**

Does your child have leg pains at night? **I would like to interview boys and girls ages 6 to 12 about their experiences with “growing pains”.** Children of similar ages will be asked to talk in groups of three to five for about an hour. Some children might be interviewed individually. The interviews will be conducted at the University of Saskatchewan by Ms. Faizah Visram (doctoral student in clinical psychology). Parents will be given a \$5.00 honorarium and children will be given Ruckers® tokens. To find out more please call Faizah at the Child Health Research Group (966-2039).

**Study on Growing Pains**

Does your child have leg pains at night? **We would like to interview boys and girls ages 6 to 12 about their experiences with “growing pains”.** Children of similar ages will be asked to talk in groups of three to five children for about an hour. Some children might be interviewed individually. The groups will be conducted at the University of Saskatchewan and will be facilitated by Ms. Faizah Visram (doctoral student in clinical psychology). Parents will be given a \$5.00 honorarium and children will be given Ruckers® tokens. To find out more please call Faizah at the Child Health Research Group (966-2039).

**Study on Growing Pains**

Does your child have leg pains at night? **I would like to interview boys and girls ages 6 to 12 about their experiences with “growing pains”.** Children of similar ages will be asked to talk in groups of three to five for about an hour. Some children might be interviewed individually. The groups will be conducted at the University of Saskatchewan and will be facilitated by Ms. Faizah Visram (doctoral student in clinical psychology). Parents will be given a \$5.00 honorarium and children will be given Ruckers® tokens. To find out more please call Faizah at the Child Health Research Group (966-2039).

APPENDIX I  
EXAMPLE OF A RECRUITMENT EMAIL TO A SCHOOL DIVISION

Subject: Notice for School Newsletters

Dear [Name]

I would be grateful if you would consider putting a notice in school newsletters about a study I am doing on so called “Growing Pains” (recurrent leg pain in children). I have had a few calls about my research from parents outside of Saskatoon and would like to reach more parents and children through school newsletters in the [Name] School Division. The recruitment notice invites parents to call me to find out more about the study if their children are interested in participating. I will be inviting children to participate over the next few months. I have attached the notice for you to review; please select whichever version you prefer or feel free to reformat it to suit the newsletters.

This study is part of a doctoral dissertation that is funded by the Saskatchewan Health Research Foundation and the Canadian Institutes of Health Research. The study involves interviewing children (aged 6 to 12) in groups or individually about their experiences with growing pains. Children will be interviewed at the University of Saskatchewan. I will ask children about the symptoms they experience, coping methods, their understanding of the cause of the pain, effect of the pain on mood and activity, and how others respond when they are in pain. It is hoped that the information from this study will be beneficial to physicians and will encourage further research on growing pains, including research on how to help children better manage and alleviate the pain. The study has received ethical approval from the University of Saskatchewan Behavioural Research Ethics Board (Beh #06-36).

I will call you next week to discuss any questions you might have about the recruitment notice or about the study. You can contact me at 966-2039 or by email at [faizah.visram@usask.ca](mailto:faizah.visram@usask.ca)

Thank you for considering this request.

APPENDIX J  
ARTICLE IN THE SASKATOON SUN

Saskatoon Sun, Sunday, September 24, 2006 15

## *Researcher explores growing pains*

By Angela Hill

Research communications, University of Saskatchewan

Growing pains can be a frightening experience made worse by the fact that little is known about them. Faizah Visram, a graduate student at the University of Saskatchewan, is trying to shed some light on this.

"Parents shouldn't be too concerned about it," Visram said. "It is a benign condition and it goes away."

Although some children won't be affected, others will experience growing pains, which might keep them awake at night.

"I was just like yelling and screaming because it hurt so much," said an 8-year-old interview participant of Visram. "It's kind of hard to go to sleep when it hurts."

The lack of understanding about growing pains is something Visram wants to change by creating a widely accepted definition of the phenomenon. Despite its short-lived nature, Visram sees it as something worthwhile to examine because some children lack good mechanisms for coping with pain. These are the children she wants to help.

"I wanted to expand on the literature about growing pains," she said. She believes a definition will lead to a continuity of treatment.

As part of her research with the U of S Child Health Research

Group Visram surveyed physicians across Canada about how they defined growing pains, as well as other details about the patients' experience with the pain. It seemed each doctor had a different way to describe the phenomenon but typically the pains were recurrent and brief, occurring in the leg muscles in the evening or at night. Some children found relief through massage, stretching, heat pads or in some cases doctor-recommended medication such as acetaminophen or ibuprofen.

The next phase in this study, funded by Canadian Institutes for Health Research and the Regional Partnership Program with Saskatchewan Health Research Foundation, is discussing children's and their parent's experience with growing pains.

Visram is looking to interview children, between the ages of six and 12 and have their parents fill out a questionnaire. If your child is interested in participating please call Ms. Faizah Visram at 966-1349 or email her at [faizah.visram@usask.ca](mailto:faizah.visram@usask.ca). Parents will be given a \$5.00 honorarium for their time and children will be given Ruckers tokens.

# Growing a real pain for many children

## – *Research hopes to define condition* –

By Brian Cross

Throbbing legs, aching thighs and painful, sleepless nights – if you're the parent of a child who suffers from growing pains, you're probably all too familiar with these symptoms.

But according to University of Saskatchewan graduate student Faizah Visram, parents and physicians know surprisingly little about growing pains, and academic research on the topic is limited.

"We don't really know what causes it," said Visram. "In fact, there isn't even a common definition that's used by physicians to describe growing pains."

A member of the Child Health Research Group at the U of S, Visram is attempting to learn more about growing pains, a condition that affects many children. "The prevalence varies from 2.6-40 per cent in children aged four to 19," she said. "We don't know the prevalence in two-to-three-year-olds, but the condition certainly occurs in children of this age."

### Potential treatments

And she is hoping to develop a definition of growing pains that is widely accepted by health care professionals. By arriving at such a definition and developing a conceptual model of the condition, Visram will be able

to assist doctors in diagnosing growing pains. The research will also help to identify potential treatments and will enable researchers to evaluate treatments in controlled studies.

"There's been limited research on how to treat and manage growing pains," Visram said. "I'm hoping that by getting a broader idea of what growing pains are and what children's experiences are, we will have some new ideas of where to go with treatment studies."

Because the definition of growing pains varies from doctor to doctor, diagnosis and treatment can be difficult. In a recent survey, Visram contacted physicians across Canada and asked them to provide their own definitions of growing pains.

Definitions were varied but most physicians described growing pains as intermittent leg pains that occur in the evening or at night. The pain is bilateral, meaning it occurs in both legs, although not necessarily in both legs at the same time.

Some physicians included arm pains in the definition and some indicated that the pains can also occur during the day.

One treatment study examined by Visram discussed the benefits of stretching as a way to

minimize pain. Other common treatments include the use of massages, heating pads and over-the-counter drugs such as acetaminophen or ibuprofen.

### Children surveyed

As a next step in her studies, Visram is planning to survey children who suffer from growing pains. She hopes to interview children and their parents to learn more about the types of pain that children experience.

Children between the ages of six and 12 will be interviewed in groups while their parents will be asked to fill out a questionnaire.

"What I want to do is find out what kids think about the pain, how they cope with it, how they manage it, and what their experiences are."

Children and parents who wish to take part in the study can contact Visram at 966-1349. She can also be reached by e-mail at [faizah.visram@usask.ca](mailto:faizah.visram@usask.ca). Parents who participate in the study will receive a \$5 honorarium. Children will receive free Ruckers tokens.

---

*Brian Cross is a  
Saskatoon freelance writer.*

October 6, 2006

APPENDIX L  
**Questionnaire on Growing Pains**

This questionnaire asks about **your** experiences (#1-13)  
and **your child's** experiences (#14-26) with leg aches.

1. Did you have growing pains as a child or adolescent?
- ☐ Yes
  - ☐ No → *go to question 13*

At what ages did your own growing pains occur?

2. Where did your own growing pains happen? (*you can tick more than one box*)
- ☐ Only right leg
  - ☐ Only left leg
  - ☐ Sometimes right and sometimes left leg
  - ☐ Both legs at the same time
  - ☐ Thighs
  - ☐ Calves
  - ☐ Shins
  - ☐ Feet
  - ☐ Around the knee

3. Did your own leg aches fit the following criteria for growing pains? (*tick all boxes that apply*)
- ☐ Occurred at least 3 times over a 3 month period
  - ☐ Tended to occur in the early evening or at night
  - ☐ Occurred in both legs (not necessarily at the same time)
  - ☐ Were not accompanied by swelling

4. How often did you have growing pains?

APPENDIX L (continued)  
**Questionnaire on Growing Pains**

**Please do not write your name or your child's name on this questionnaire**

5. When did the growing pains happen? *(you can tick more than one box)*
- ☐ When you woke up
  - ☐ At school
  - ☐ At bedtime
  - ☐ In the middle of the night
6. Did you ever have any of the following troubles with sleep because of growing pains *(you can tick more than one box)*
- ☐ Getting to sleep
  - ☐ Waking up in the middle of the night
7. Did you ever have trouble with the following activities because of growing pains *(you can tick more than one box)*
- ☐ Gym class
  - ☐ Chores
  - ☐ Hobbies
  - ☐ School work
8. What helped you when you had growing pains? *(you can tick more than one box)*
- ☐ Medication
  - ☐ Hot water bottle or heat pad
  - ☐ Rubbing your legs
  - ☐ Having somebody rub or massage your legs
  - ☐ Stretching
  - ☐ Other: \_\_\_\_\_
9. What made the growing pains worse?
10. Did you ever see a physician about the growing pains? If yes, what did he or she say about them?



Appendix L (continued)  
**Questionnaire on Growing Pains**

11. Why do you think you had growing pains?
12. Have you had the same kind of pain since your childhood? If yes, please describe when the growing pains happened or when they tend to happen.
13. Do you get restless legs (a feeling of discomfort in the legs that tends to happen in the evening; you may feel an urge to move about when sitting or lying down)? If yes, when did this start and how often does it happen?

---

**THE NEXT QUESTIONS REFER TO YOUR CHILD'S GROWING PAINS**

14. Has anyone in your family had growing pains? If yes, please say how they are related to your child?
15. What do you think are some possible reasons for your child's growing pains?

Appendix L (continued)  
**Questionnaire on Growing Pains**

16. What do you and other family members do when your child has growing pains?
  
  
  
  
  
  
  
  
  
  
17. What is most helpful for your child when he or she has growing pains?
  
  
  
  
  
  
  
  
  
  
18. Has your child seen a physician about his or her growing pains?  
If so, what was the physician's speciality area and what was the outcome of this visit?
  
  
  
  
  
  
  
  
  
  
19. How do you feel about giving your child medication when he or she has growing pains?
  
  
  
  
  
  
  
  
  
  
20. Do you have any concerns about your child's growing pains? If so, please describe them.

Appendix L (continued)  
**Questionnaire on Growing Pains**

21. Roughly how many hours of physical activity (e.g. sports, chores such as shovelling, gym class) does your child do a week?
22. What is your child's date of birth?
23. Is your child male or female?
24. In the last 3 months how often has your child had growing pains?
- ☐ Once a month
  - ☐ Once a week
  - ☐ More than once a week
  - ☐ Nearly every day
  - ☐ Less than once a month: Please describe\_\_\_\_\_
  - ☐ Other: Please describe\_\_\_\_\_
25. At what age did your child start having growing pains?
26. Please write anything else you would like to say about your or your child's experiences with growing pains. Use the back page if you need more space.

Appendix L (continued)  
**Questionnaire on Growing Pains**

I am asking the following questions in order to look at whether growing pains tends to run in families.

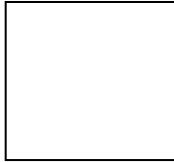
1. Are you male or female?
2. Are you the child's biological parent?
  - ☐ Yes
  - ☐ No → *go to question 4*
3. Did your child's other biological parent have growing pains?
  - ☐ Yes
  - ☐ No
  - ☐ Don't know
4. If you are not the biological parent, do you know if your child's biological parents had growing pains? Please state which parent.

**Thank you for completing this questionnaire!**

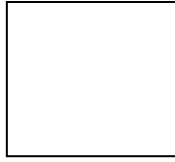
APPENDIX M  
Body Diagram from PedsQL Pediatric Pain Questionnaire (Ages 5-12)

Pick the colors that mean **No hurt**, **A little hurt**, **More hurt**, and **A lot of hurt** to you and color in the boxes. Now, using these colors, color in the body to show how you feel. Where you have no hurt, use the **No hurt** color to color in your body. If you have hurt or pain, use the color that tells how much hurt you have.

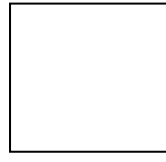
No pain  
No hurt



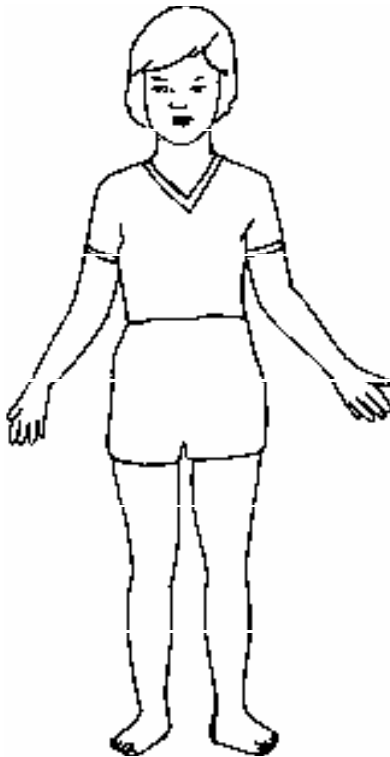
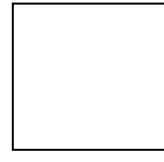
Mild pain  
A little hurt



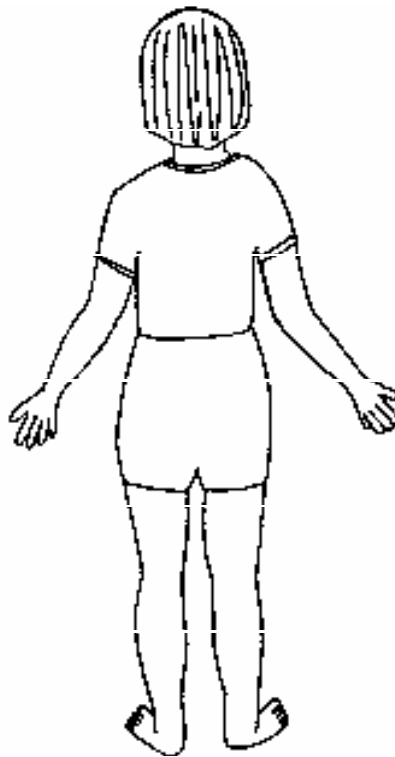
Moderate pain  
More hurt



Severe pain  
A lot of hurt



Front



Back

Appendix N  
The Adolescent Pediatric Pain Tool (APPT)

**Point to or circle as many of these words that describe your pain.**

1	5	10	15
annoying bad horrible miserable	blistering burning hot	awful deadly dying killing	off and on once in a while sneaks up sometimes steady
2	6	11	
aching hurting like an ache like a hurt like a sore	cramping crushing like a pinch pinching pressure	crying frightening screaming terrifying	
3	7	12	
beating hitting pounding punching throbbing	itching like a scratch like a sting scratching stinging	dizzy sickening suffocating	
4	8	13	
biting cutting like a pain like a sharp knife pin like sharp stabbing	shocking shooting splitting	never goes away uncontrollable	
	9	14	
	numb stiff swollen tight	always comes and goes comes on all of a sudden constant continuous forever	

## APPENDIX O

### MODERATOR'S GUIDE FOR FOCUS GROUPS ON GROWING PAINS

*Warm up:* I'd like each one of you to say your name and say what your favourite thing to do is. I'll start. My name is Faizah and I like to go horse riding. Now let's go round, starting here.

*Introduction:* Introduce self

Go over format: "I'll be asking you some questions about having growing pains. There are no right or wrong answers to the questions. I just want to hear about what you think or feel. I'd like it if you ask each other questions too. Your parents won't hear what you say. Only the people in this room will hear what you have to say and the people who are helping me with this project. When I ask a question you don't have to put your hand up to answer. But, I want to hear all your answers, so when you have something to say please wait until the person who's talking stops. When someone says something, you might think the same thing as them or think something else. It's important to let me know when you think the same thing and when you think something different. Are there any questions?"

*Activity:* Now, I'm going to give each of you a picture. I'd like you to colour on the body shape the places where you get growing pains.  
Are there any questions?

*Activity:* Here's a list of words. Circle the words that say how growing pains feel.

*Questions:*

1. Some people call the type of pain you have growing pains and other people call it leg aches. What do you call it?
2. What are growing pains like?
  - Can ask them to refer to pictures & word lists
  - Does it always hurt in the same place?
  - When does it happen?
  - How long does it last?
3. Remember the last time you had growing pains? Tell me what it was like.
  - Where did it hurt?
  - How long did it hurt for?
  - What did you do?

APPENDIX O (continued)  
MODERATOR'S GUIDE FOR FOCUS GROUPS ON GROWING PAINS

4. What makes the growing pain worse?
  - activities?
  - things you do?
  - things people say?
  - things people do?
5. Are there times when you can't do things because of growing pains?
  - At school (what does the teacher say?)
  - At home
  - Physical activity
  - Sleep
6. Does the pain make it hard to get to sleep?
  - Do you wake up because of the pain?
  - What do you do when this happens?
7. Tell me all the things you do when you're having growing pains?
  - Some children like to do something active when they are in pain, like go for a walk. Other children like to do things like lie down. What do you like to do when you're having growing pains?
  - Is that helpful?
  - Does that work when you have other kinds of pain like a headache?
  - What's not helpful when you're having growing pains?
8. What do your parents or other members of your family (grandparents, brothers or sisters) say when you have growing pains?
  - What do your parents do when you have growing pains?
  - What do you not like about what your parents do when you have growing pains?
  - What do you like about what your parents do.
9. Have you been to the doctor about your pain?
  - What did the doctor say?
  - What did you think after the doctor said that?
10. Why do you think growing pains happen?
  - What have your parents said about why they happen?
  - What has your doctor said about why they happen?
  - What do you think about what they had to say?
11. Are there certain days when the pain is worse?
  - If yes: Why do you think that is?



APPENDIX O (continued)  
MODERATOR'S GUIDE FOR FOCUS GROUPS ON GROWING PAINS

12. Does anyone else in your family have growing pains?  
- What have they said about it?

Wrap up: We're almost out of time. Is there anything else you want to tell me about growing pains?

Closing: Thank you all for coming here today. I enjoyed talking with you. You've helped me understand what growing pains are like. Do you have any last questions?

## APPENDIX P

### ETHICAL APPROVAL FOR THE STUDY CONDUCTED IN PHASE III



University of Saskatchewan  
Behavioural Research Ethics Board (Beh-REB)

6-Mar-2006

### *Certificate of Approval with Minor Modifications*

PRINCIPAL INVESTIGATOR  
Carl von Baeyer

DEPARTMENT  
Psychology

BEH#  
06-36

STUDENT RESEARCHER(S)  
Faizah Visram

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED (STUDY SITE)  
University of Saskatchewan

SPONSOR  
CANADIAN INSTITUTES FOR HEALTH RESEARCH (CIHR)

TITLE  
Growing Pains: The Child's Perspective

ORIGINAL APPROVAL DATE  
15-Feb-2006

CURRENT RENEWAL DATE  
01-Feb-2007

#### CERTIFICATION

Thank you for submitting the above application to the Behavioural Research Ethics Board for review. The Beh-REB has **approved** your research proposal on ethical grounds, **subject to the following minor modifications:**

- Please revise Appendix D, such that:
  - The phrase, "It could be fun for you and it will be really helpful to me" is removed.
  - The phrase "I hope you'll" is replaced by "you can" in the third paragraph.

Please send one copy of your revisions to the Ethics Office for our records. **Please highlight or underline any changes made when resubmitting.**

The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.

Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

This letter serves as your Certificate of Approval, **effective as of the time that the requested modifications are received by the Ethics Office**. If you require a letter of unconditional approval, please so indicate on your reply, and one will be issued to you.

#### ONGOING REVIEW REQUIREMENTS

The term of this approval is five years. However, the approval must be renewed on an annual basis. In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions: <http://www.usask.ca/research/ethical.shtml>.

Dr. Valerie Thompson, Chair  
Behavioural Research Ethics Board  
University of Saskatchewan

Please send all correspondence to:

Ethics Office  
University of Saskatchewan  
Room 306 Kirk Hall, 117 Science Place  
Saskatoon SK S7N 5C8  
Telephone: (306) 966-2084 Fax: (306) 966-2069

APPENDIX P (continued)  
ETHICAL APPROVAL FOR THE STUDY CONDUCTED IN PHASE III



University of Saskatchewan  
Behavioural Research Ethics Board (Beh-REB)

14-Aug-2006

**Certificate of Approval**  
**Study Revisions**

PRINCIPAL INVESTIGATOR  
Carl von Baeyer

DEPARTMENT  
Psychology

BEH#  
06-36

STUDENT RESEARCHER(S)  
Faizah Visram

INSTITUTION(S) WHERE RESEARCH WILL BE CONDUCTED (STUDY SITE)  
University of Saskatchewan  
Saskatoon SK

SPONSOR  
CANADIAN INSTITUTES OF HEALTH RESEARCH (CIHR)  
TITLE  
Growing Pains: Children's and Parents' Perspectives

CURRENT APPROVAL DATE  
08-Mar-2006

CURRENT RENEWAL DATE

CERTIFICATION UPDATE  
- Revised protocol  
- Revised consent  
- Revised recruitment protocol

01-Mar-2007  
APPROVED ON  
14-Aug-2006

**CERTIFICATION**

The University of Saskatchewan Behavioural Research Ethics Board has reviewed the proposed revisions to your study. The revisions were found to be acceptable on ethical grounds.

The principal investigator has the responsibility for any other administrative or regulatory approvals that may pertain to this research project, and for ensuring that the authorized research is carried out according to the conditions outlined in the original protocol submitted for ethics review. This Certificate of Approval is valid for the above time period provided there is no change in experimental protocol or consent process or documents.


Any significant changes to your proposed method, or your consent and recruitment procedures should be reported to the Chair for Research Ethics Board consideration in advance of its implementation.

**ONGOING REVIEW REQUIREMENTS**

The term of this approval is five years, but the approval must be renewed on an annual basis. In order to receive annual renewal, a status report must be submitted to the REB Chair for Board consideration within one month of the current expiry date each year the study remains open, and upon study completion. Please refer to the following website for further instructions:

<http://www.usask.ca/research/ethical.shtml>

APPROVED.

  
John Rigby, Chair  
Behavioural Research Ethics Board  
University of Saskatchewan

Please send all correspondence to:

Ethics Office  
University of Saskatchewan  
Room 306, Kirk Hall, 117 Science Place  
Saskatoon, SK S7N 5C8  
Phone: (306) 966-2084 Fax: (306) 966-2069

APPENDIX Q  
CONSENT FORM FOR FOCUS GROUPS

You are invited to participate in a study entitled “**Growing Pains: Children’s and Parents’ Perspectives**”. Please read this form carefully, and feel free to ask questions you might have.

**Researcher(s):** Faizah Visram, BA Hon, Department of Psychology, 966-1349  
Carl von Baeyer, PhD, Department of Psychology, 966-6676  
(supervisor)

**Purpose and Procedure:** The purpose of this study is to find out about children’s experiences with growing pains. Your child will participate in a group discussion with 2 to 5 other children, which will be facilitated by Ms. Visram. Starting with one or two warm-up games or activities appropriate to the age group, the discussion will be approximately 45 minutes and will be videotaped and audio-taped. Children will be asked about their symptoms, coping methods, understanding of the cause of the pain, possible effects of the pain on mood and activity, and how others respond when they are in pain. They will also be asked to identify areas of pain on a body diagram and to circle words that describe their pain. While your child is participating in the group interview, you will be able to wait in the next room.

**Potential Risks:** There are no known risks to participation in this study.

**Potential Benefits:** There are no known direct benefits to participants. However, we anticipate that the information from the study will help physicians and researchers better understand children’s experiences with growing pains.

**Confidentiality:** To encourage children to provide the best information possible, we will let them know that only the researchers will see and hear the videotapes; other people such as their parents will not see or hear the tapes or be told what they say, although they can tell their own parents about their own responses during the interview. Because children are participating in a group discussion, we cannot guarantee that they will not disclose other members’ comments to non- participants. The data from this study will be published and presented at conferences, however, participants’ identities will be kept confidential. Although we will report direct quotations from the interview, children will be referred to by another name and no identifying information will be in the report.

APPENDIX Q (continued)  
CONSENT FORM FOR FOCUS GROUPS

**Storage of Data:** The data, including videotapes, audiotapes, and transcripts, will be securely stored in the researcher's lab for 5 years in accord with university regulations.

**Right to Withdraw:** Your participation is voluntary, and you may withdraw your child from the study for any reason, at any time, without penalty of any sort. If you withdraw at anytime during the study you will still receive an honorarium of \$5.00 or coupons, whichever you prefer. Your child may refuse to answer any questions during the interview. If you withdraw from the study at any time, any data that you have contributed will not be used but will be securely stored in the researcher's lab for 5 years.

**Questions:** If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided above if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on (insert date). Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Out of town participants may call collect. Results of the study will be posted on our website at [www.usask.ca/childpain](http://www.usask.ca/childpain) by May 2007.

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**Consent to Participate:** I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I give consent for my child to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

---

(Name of Participant)

---

(Date)

---

(Signature of Participant)

---

(Signature of Researcher)

APPENDIX R  
CONSENT FORM FOR INDIVIDUAL INTERVIEWS

**Storage of Data:** The data, including videotapes, audiotapes, and transcripts, will be securely stored in the researcher's lab for 5 years in accord with university regulations.

**Right to Withdraw:** Your participation is voluntary, and you may withdraw your child from the study for any reason, at any time, without penalty of any sort. If you withdraw at anytime during the study, you will still receive a small honorarium of either \$5.00 or coupons, whichever you prefer. Your child may refuse to answer any questions during the interview. If you withdraw from the study at any time, any data that you have contributed will not be used but will be securely stored in the researcher's lab for 5 years.

**Questions:** If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided above if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on August 14, 2006. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Out of town participants may call collect. Results of the study will be posted on our website at [www.usask.ca/childpain](http://www.usask.ca/childpain) by May 2007.

---

**Consent to Participate:** I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I give consent for my child to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

---

(Name of Participant)

---

(Date)

---

(Signature of Participant)

---

(Signature of Researcher)

APPENDIX S  
CONSENT FORM FOR PARENT QUESTIONNAIRE

You are invited to participate in a study entitled “**Growing Pains: Children’s and Parents’ Perspectives**”. Please read this form carefully, and feel free to ask questions you might have.

**Researcher(s):** Faizah Visram (BA Hon), Department of Psychology, 966-1349  
Carl von Baeyer (PhD), Department of Psychology, 966-6676  
(supervisor)

**Purpose and Procedure:** The purpose of this part of the study is to find out about parents’ experiences with growing pains. If you want to participate in this part of the study you will be asked to fill out a questionnaire while your child is being interviewed. The questionnaire asks about your personal experiences with growing pains and your experiences caring for your child. If you have not had growing pains yourself, you can skip the section that asks about personal experiences with growing pains. The questionnaire will likely take 15 – 30 minutes to complete.

Your child can participate in the interview regardless of whether you participate in filling out the questionnaire.

**Potential Risks:** There are no known risks to participation in this study.

**Potential Benefits:** There are no known direct benefits to participants. However, we anticipate that the information from the study will help physicians and researchers better understand children’s and parents’ experiences with growing pains.

**Confidentiality:** To keep your information confidential we ask that you not write your name on the questionnaire. The data from this study will be published and presented at conferences, however, participants identities will be kept confidential. Although we may report direct quotations from questionnaire, participants will be given a pseudonym and no identifying information will be in the report.

APPENDIX S (continued)  
CONSENT FORM FOR PARENT QUESTIONNAIRE

**Storage of Data:** The data will be securely stored in the researcher's lab for 5 years in accord with university regulations.

**Right to Withdraw:** Your participation is voluntary, and you may withdraw from the study for any reason, at any time, without penalty of any sort. If you withdraw from the study at any time, any data that you have contributed will not be used but will be securely stored in the researcher's lab for 5 years.

**Questions:** If you have any questions concerning the study, please feel free to ask at any point; you are also free to contact the researchers at the numbers provided above if you have questions at a later time. This study has been approved on ethical grounds by the University of Saskatchewan Behavioural Research Ethics Board on August 14, 2006. Any questions regarding your rights as a participant may be addressed to that committee through the Ethics Office (966-2084). Out of town participants may call collect. Results of the study will be posted on our website at [www.usask.ca/childpain](http://www.usask.ca/childpain) by May 2007.

---

**Consent to Participate:** I have read and understood the description provided above. I have been provided with an opportunity to ask questions and my questions have been answered satisfactorily. I give consent to participate in the study described above, understanding that I may withdraw this consent at any time. A copy of this consent form has been given to me for my records.

---

(Name of Participant)

---

(Date)

---

(Signature of Participant)

---

(Signature of Researcher)



APPENDIX T  
ASSENT FORM FOR 6-8 YEAR OLDS

Hi (child's name). I'd like to tell you about a project that I'm working on and see if you'd like to help. It could be fun for you and it will be really helpful for me.

We're learning what kids think about their legs hurting, and how their parents try to help. I want to invite you to talk with me and a little group of other children.

If you say yes, here's what will happen:

You'll get to meet three or four other children. You probably won't already know them. Your parent will wait for you in another room nearby.

In the little group, we'll play a short game to get to know each other. Then, I'll ask everyone to mark on a picture of a body to show where you hurt. I'll also ask you to pick some words on a paper that say how you feel. (Researcher's name) can help with this if you want. This part will take about 10 minutes. Then, we will talk in the group for about half an hour.

We'll have a video camera to record what the kids say. But we won't show the tape to anybody except at the university. We won't tell anybody else what you say in the group, even your parents.

The project is only talking in a circle and writing or drawing. Nobody will touch your legs or do anything medical at all.

Of course if you decide that you'd like to stop, you can stop any time, no problem.

Most kids who help us with projects think it's very interesting and fun. I hope you'll say yes, but you don't have to – you can say no and it won't be a problem at all.

Do you have any questions?

Would you like to be part of this project? If you would please write your name here:

\_\_\_\_\_  
Child

\_\_\_\_\_  
Researcher

\_\_\_\_\_  
Date

APPENDIX U  
ASSENT FORM FOR 9-12 YEAR OLDS

Hi (child's name). I'd like to tell you about a project that I'm working on and see if you'd like to help. It could be fun for you and it will be really helpful for me.

We're learning what children think about their legs hurting, and how their parents try to help.

I want to invite you to talk with me and a group of other children.

If you say yes, here's what will happen:

You'll get to meet three or four other children. You probably won't already know them. Your parent will wait for you in another room nearby.

In the group we'll get to know each other by talking about what we each like to do. Then I'll ask you to mark on a picture where you hurt and to pick some words that say how you feel. This part will take about 10 minutes. After that, we'll talk in the group for about half an hour.

We'll have a video camera to record what everyone says. But we won't show the tape to anybody except at the university. We won't tell anybody else what you say in the group, even your parents.

The project is only talking in a circle and writing or drawing. Nobody will touch your legs or do anything medical at all.

Of course if you decide that you'd like to stop, you can stop any time, no problem.

Most children who help us with projects think it's very interesting and fun. I hope you'll say yes, but you don't have to – you can say no and it won't be a problem at all.

Do you have any questions?

Would you like to be part of this project? If you would please write your name here:

\_\_\_\_\_  
Child

\_\_\_\_\_  
Researcher

\_\_\_\_\_  
Date

APPENDIX V  
ASSENT FORM FOR INDIVIDUAL INTERVIEWS: 6 - 8 YEAR OLDS

Hi (child's name). I'd like to tell you about a project that I'm working on and see if you'd like to help. It could be fun for you and it will be really helpful for me.

We're learning what kids think about their legs hurting, and how their parents try to help. I want to invite you to talk with me.

If you say yes, here's what will happen:

I'll ask you to mark on a picture of a body to show where you hurt. I'll also ask you to pick some words on a paper that say how you feel. I can help with this if you want. This part will take about 10 minutes. Then, we'll talk for about half an hour.

I'll tape record what we say. But only me and the people I work with at the university will hear the tape. I won't tell anybody else what you say, not even your parents.

The project is only talking and writing or drawing. Nobody will touch your legs or do anything medical at all.

Of course if you decide that you'd like to stop, you can stop any time, no problem.

Most kids who help us with projects think it's very interesting and fun. I hope you'll say yes, but you don't have to – you can say no and it won't be a problem at all.

Do you have any questions?

Would you like to be part of this project? If you would please write your name here:

\_\_\_\_\_  
Child

\_\_\_\_\_  
Researcher

\_\_\_\_\_  
Date

APPENDIX W  
ASSENT FORM FOR INDIVIDUAL INTERVIEWS: 9-12 YEAR OLDS

Hi (child's name). I'd like to tell you about a project that I'm working on and see if you'd like to help. It could be fun for you and it will be really helpful for me.

We're learning what children think about their legs hurting, and how their parents try to help. I want to invite you to talk with me.

If you say yes, here's what will happen:

I'll ask you to mark on a picture where you hurt and to pick some words that say how you feel. This part will take about 10 minutes. After that, we'll talk for about half an hour.

I'll tape-record what we say. But I won't show the tape to anybody except at the university. We won't tell anybody else what you say, even your parents.

The project is only talking and writing or drawing. Nobody will touch your legs or do anything medical at all.

Of course if you decide that you'd like to stop, you can stop any time, no problem.

Most children who help us with projects think it's very interesting and fun. I hope you'll say yes, but you don't have to – you can say no and it won't be a problem at all.

Do you have any questions?

Would you like to be part of this project? If you would please write your name here:

\_\_\_\_\_  
Child

\_\_\_\_\_  
Researcher

\_\_\_\_\_  
Date